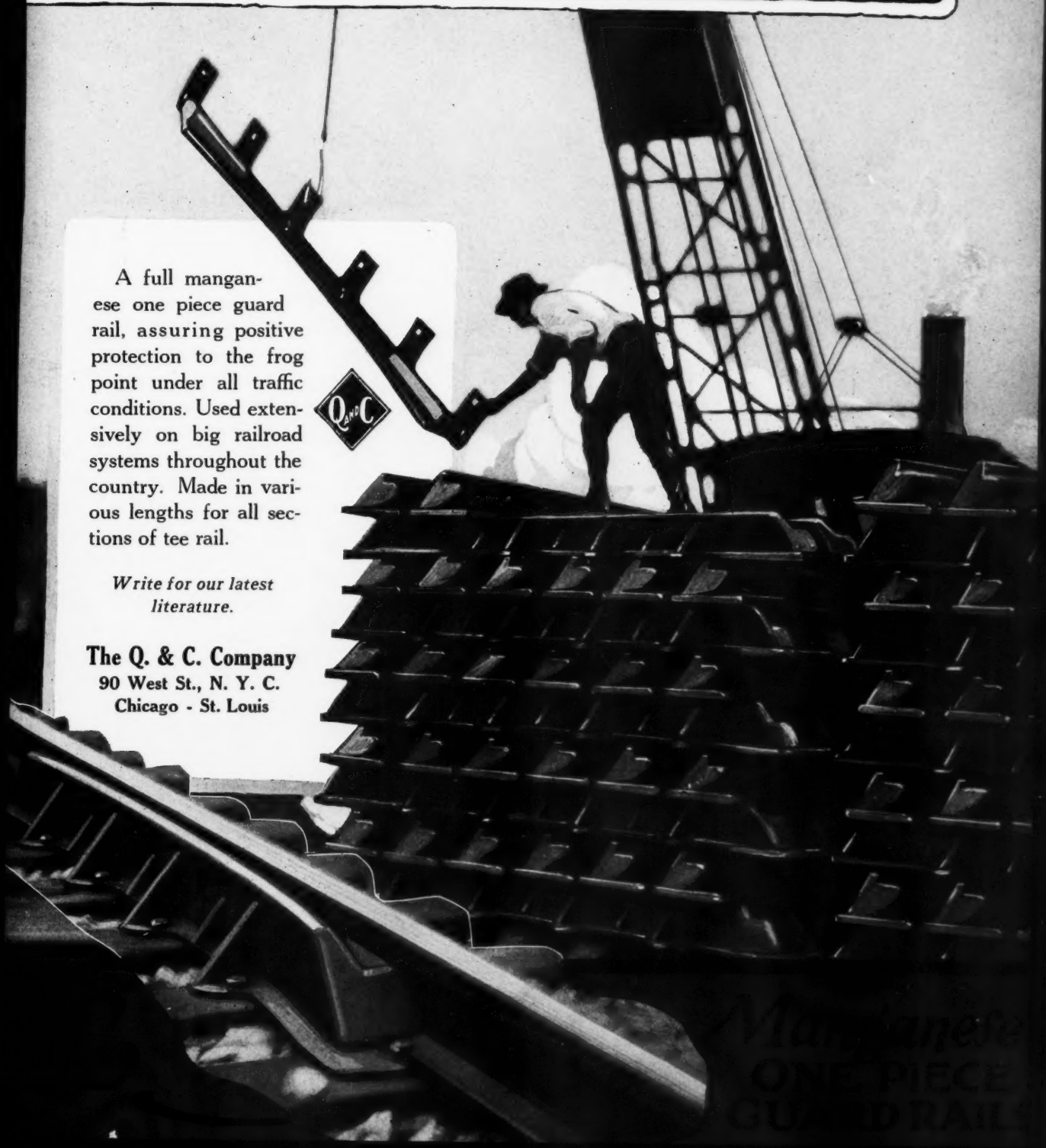
OCTOBER, 1925
ROADMASTERS' CONVENTION NUMBER

Railway Engineering and Maintenance



A full manganese one piece guard rail, assuring positive protection to the frog point under all traffic conditions. Used extensively on big railroad systems throughout the country. Made in various lengths for all sections of tee rail.

Write for our latest literature.

The Q. & C. Company
90 West St., N. Y. C.
Chicago - St. Louis

MANY nut locks quickly flatten under present day traffic tonnage because they lack those inherent qualities of greater strength and endurance which has enabled Hy-Crome to repeatedly deliver under every condition definite savings in track maintenance.

Special treatment has given Hy-Crome a non-fatiguing spring action. This irreducible and unrelaxing gripping power guarantees that permanent rail joint security for which your nut lock dollars are spent.

THE RELIANCE MFG. CO.

MASSILLON, OHIO

NEW YORK CLEVELAND DETROIT CHICAGO
ST. LOUIS SAN FRANCISCO

Montreal, Quebec, Canada, McGill Bldg., Engineering Materials, Ltd.
N. S. Kenney, Munsey Bldg., Baltimore, Md.

What do you buy in a Nut Lock?

HY-CROME

RAILWAY ENGINEERING AND MAINTENANCE

Published monthly by Simmons-Boardman Publishing Co., at 608 S. Dearborn St., Chicago. Subscription price: United States, Canada and Mexico, $2.00; foreign countries, $3.00 a year. Single copy, 35 cents. Entered at Chicago, Ill., as second-class matter.

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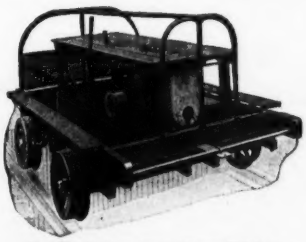
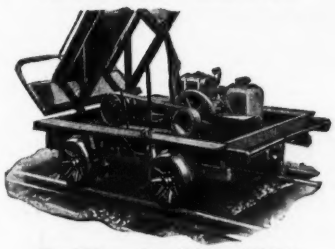
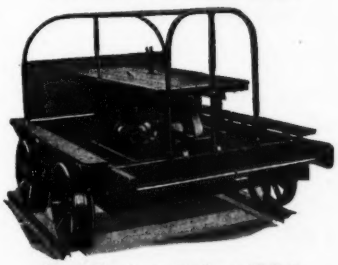
Sturdy Track Tools



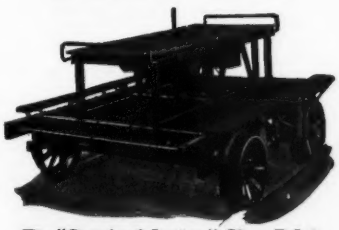
The "All-Service" Class W S-2



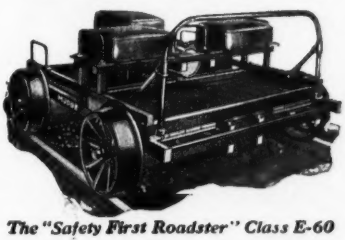
The "Heavy Duty" Class W S-3



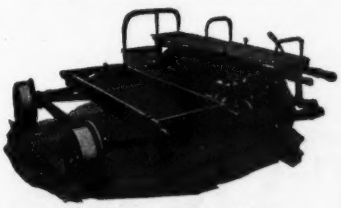
The "Wonderpull" Class G S-4



The "Standard Section" Class E S-3



The "Safety First Roadster" Class E-60



The "Special" Class E-11

Mudge Cars

Well Manufactured
Built of Finest Materials
Backed by a Guarantee

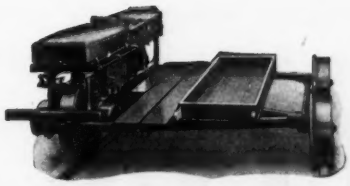
Supported by

Intelligent Service
Experienced Understanding
Established Responsibility

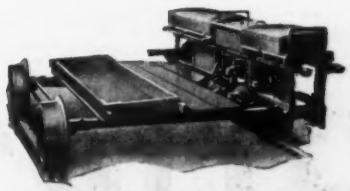
TRADE MARK
RAILROAD SUPPLIES
CHICAGO
MUDGE

Mudge & Company

Manufacturers—Railroad Equipment
Railway Exchange Bldg. - CHICAGO



The "Hill Climber" Class E-4



The "Power Queen" Class G-2

Steel Tanks in *all* capacities

Horton elevated steel tanks are standardized* in a *complete* range of capacities for railroad purposes.

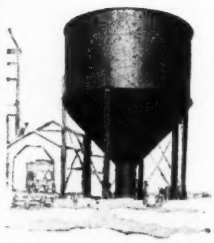
From 15,000 to 300,000 gallons, you will find the size you need standardized and ready for quick delivery from the nearest of the three Horton plants.

Midland Valley Railroad, Wichita, Kan. Capacity 50,000 Gallons

Horton tanks are *steel*—rot-proof, leak-proof, strong, tough, resistant, safe, requiring nothing but paint to make them last indefinitely. They are pleasing to the eye. They tell the public that you have modern equipment on your road.

Horton steel tanks are adaptable for roadside delivery, water softening, settling service and oil storage.

Right now you may need a tank somewhere on your road for one of these purposes. In Horton tanks you have the widest range of selection in *steel,* the backbone of construction. Our nearest office will be glad to send you a booklet applicable to your requirements or quote you on any capacity or height.



Pennsylvania System Effingham, Illinois Capacity 200,000 Gals.

CHICAGO BRIDGE & IRON WORKS

CHICAGO	NEW YORK	DALLAS	SAN FRANCISCO	ATLANTA
2452 Old Colony Building	3156 Hudson Terminal	1646 Praetorian Building	1007 Rialto Building	1036 Healey Building

HORTON STEEL WORKS, LTD., Bridgeburg, Ont.; Montreal; Toronto; Winnipeg

*"Standardized" tanks are those for which drawings, templates, steel small parts, etc., are always ready.

420

HORTON TANKS

The Kansas City Convention Hall Where the Roadmaster's Convention Was Held

Railway Engineering and Maintenance

Formerly the Railway Maintenance Engineer

Vol. 21 October, 1925 Number 10

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WOULD YOU LIKE TO KNOW

How to test the wood in a tie directly under the rail?

The cost of killing weeds by various methods?

How to lay out a pumping plant to use the fewest possible pipe fittings?

What can be gained by insisting that motor cars be kept clean?

How to brace the forms for a concrete tunnel lining?

Answers to these and other questions will be found in this issue

ELMER T. HOWSON
Editor
WALTER S. LACHER
Managing Editor
N. D. HOWARD
Associate Editor
H. F. LANE
Associate Editor
(Washington, D. C.)

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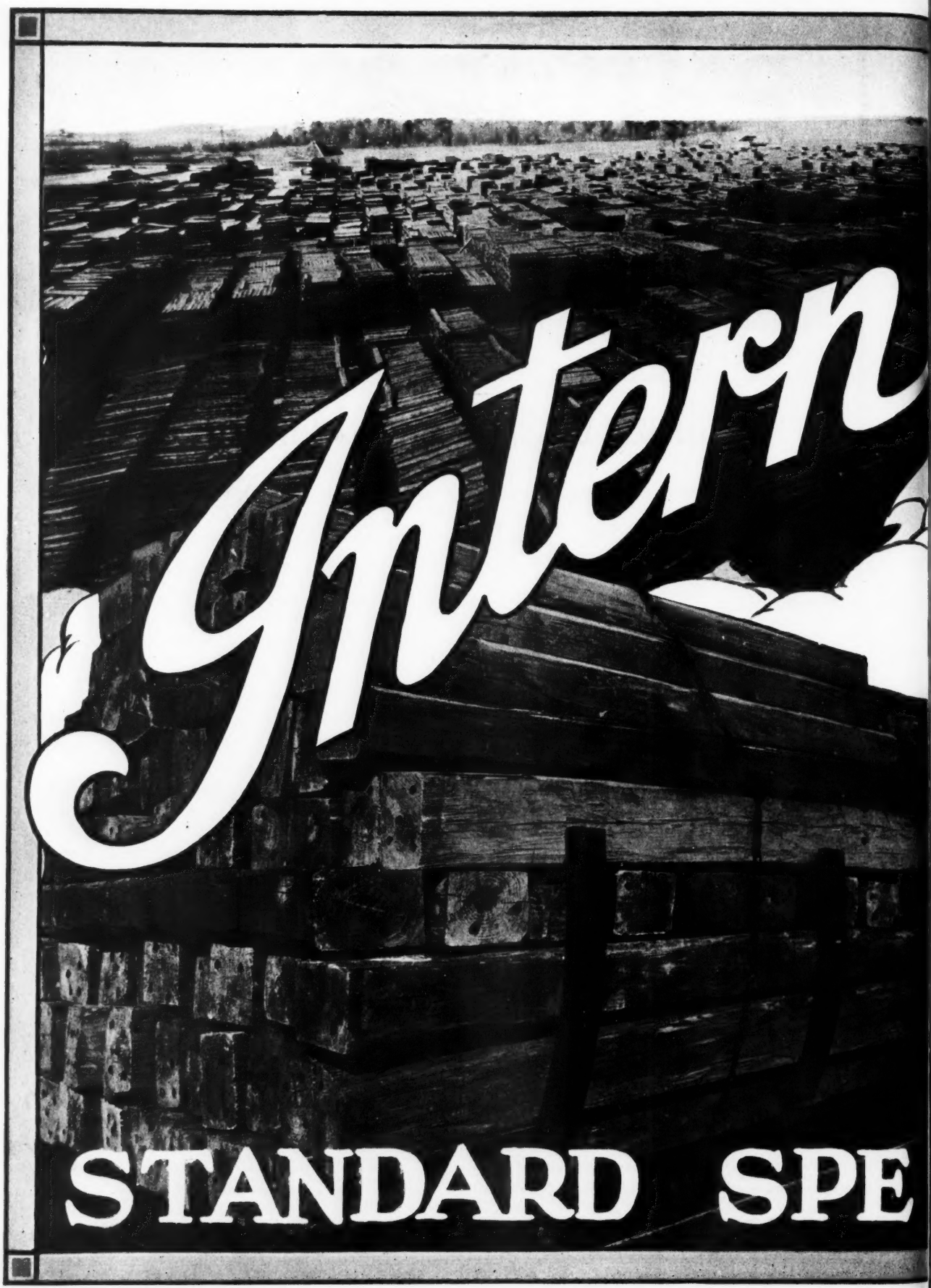
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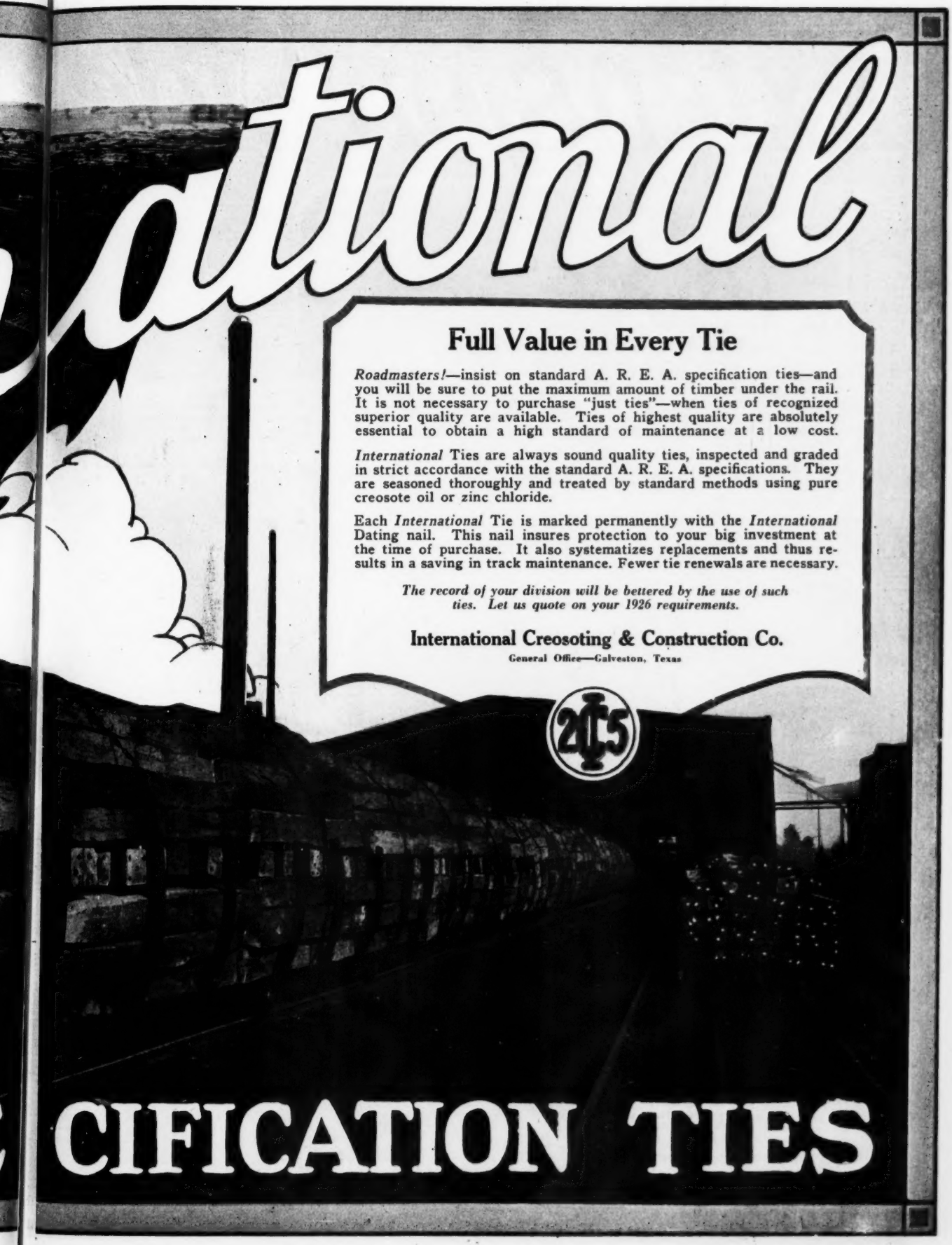
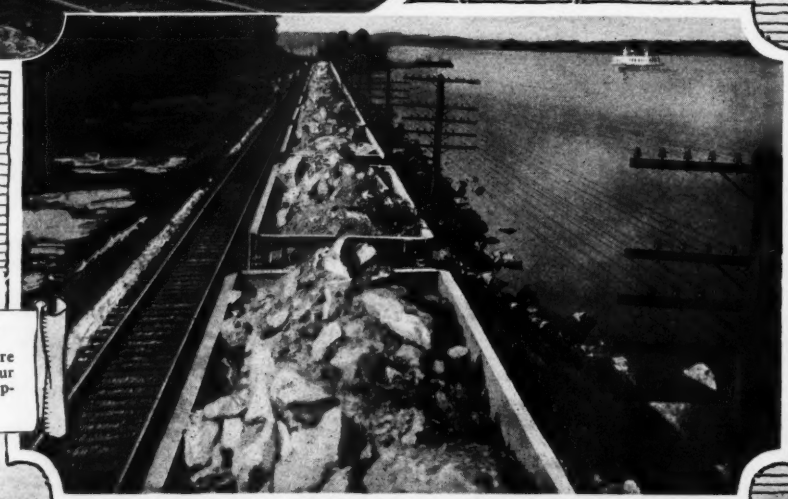

ational
Full Value in Every Tie
Roadmasters!—insist on standard A. R. E. A. specification ties—and you will be sure to put the maximum amount of timber under the rail. It is not necessary to purchase "just ties"—when ties of recognized superior quality are available. Ties of highest quality are absolutely essential to obtain a high standard of maintenance at a low cost.
International Ties are always sound quality ties, inspected and graded in strict accordance with the standard A. R. E. A. specifications. They are seasoned thoroughly and treated by standard methods using pure creosote oil or zinc chloride.
Each International Tie is marked permanently with the International Dating nail. This nail insures protection to your big investment at the time of purchase. It also systematizes replacements and thus results in a saving in track maintenance. Fewer tie renewals are necessary.
The record of your division will be bettered by the use of such ties. Let us quote on your 1926 requirements.
International Creosoting & Construction Co.
General Office—Galveston, Texas
CIFICATION TIES

Extension Side

LOADING
Cars being loaded with rocks—There are no loading restrictions because the cars can dump anything shovels can load.

IN TRANSIT
Rugged construction assures safe transportation on main line at regular train speeds.



AT DUMPING POINT
Rip-rapping on a section where two tracks handle a regular four track traffic and where interruptions could not be tolerated.

Dump Cars

Executing Important Rip-Rapping Work on Main Line Without Interruptions to Traffic

THERE are two principal reasons for assignment of 30 Extension Side Dump Cars to this rip-rapping job near Hudson, N. Y., on the New York Central Railroad.

First, the absolute dependability of operation on a section where through traffic is perhaps heavier than any other place in the United States.

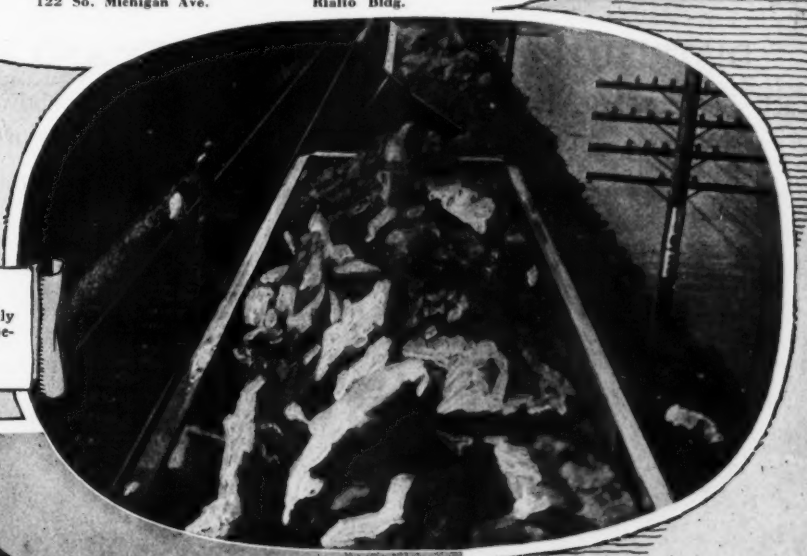
Second, the low cost of operation.

The chief advantages of this equipment are as follows:

The cars will dump safely anything the shovels will load.
Safety of hauling heavy loads on main lines at regular train speeds.
Large quantities can be transported with few units of equipment.
Free and safe discharge of large rocks used in work of this kind.
The down turning door chutes the load clear of the track.

CLARK CAR COMPANY, PITTSBURGH, PA.

New York 52 Vanderbilt Ave. | Chicago 122 So. Michigan Ave. | San Francisco Rialto Bldg.



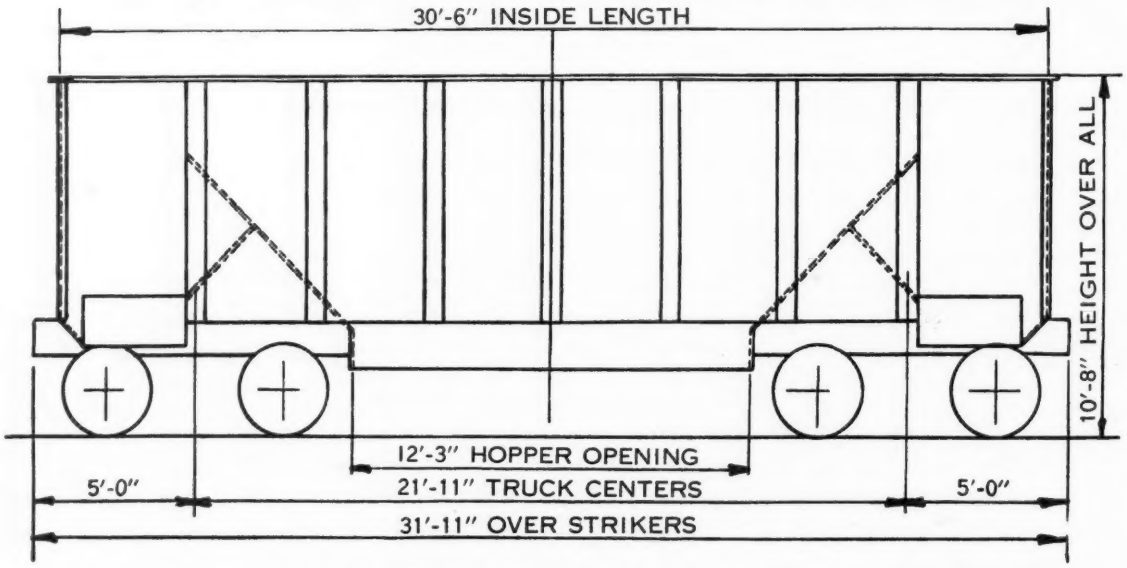
SPOTTING CARS
Cars are dumped individually here due to the limited space between telephone poles.

DUMPING
The down turning door permits the free discharge of load and chutes it clear of the track. No hand labor to clear track.

HART SELECTIVE CAR WITH "MAXENDS"

FOR BALLAST AND COAL

"MAXENDS" PROVIDE FULL MAXIMUM COAL CARRYING CAPACITY



DISTRIBUTING BALLAST TO CENTER AND TO ONE SIDE

Each side is operated independently in full view of operator as shown. Amount of distribution under control, as desired for shoulder reinforcement.

Cut to right shows same piece of track after car has passed. Note even distribution of material, no hand work having been done.

Cut to left shows actual work being done by this car, depositing material simultaneously to center and outside of elevated rail on curve for reinforcement.

RODGER BALLAST CAR COMPANY

523 Railway Exchange, 80 E. Jackson Blvd.

CHICAGO

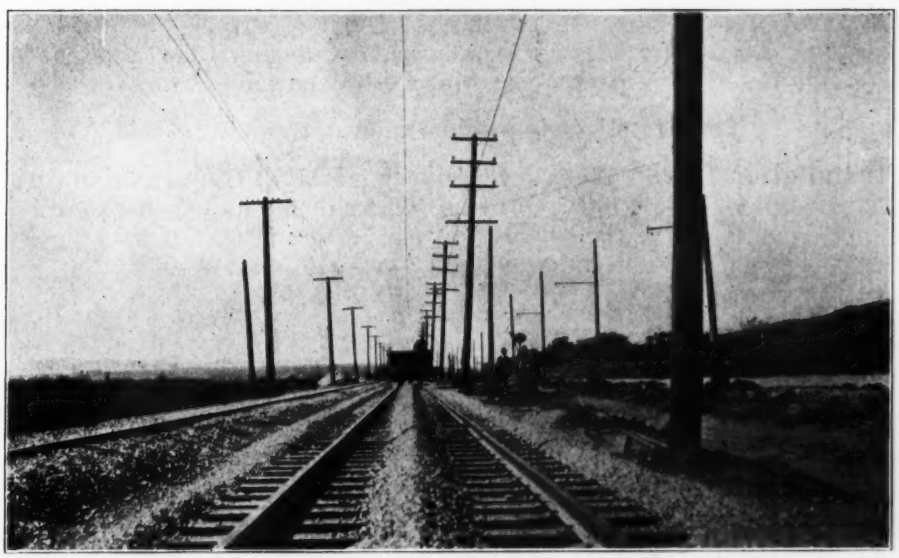
THE HART SELECTIVE BALLAST CAR

IT CANNOT FLOOD THE RAILS

MAXIMUM

VERY HEAVY DISTRIBUTION TO CENTER AND BOTH SIDES

MINIMUM



VERY LIGHT DISTRIBUTION TO CENTER AND BOTH SIDES

Places ballast material in the proper quantity just where it is needed, without flooding the rails.

We shall be glad to furnish particulars.

RODGER BALLAST CAR COMPANY

523 Railway Exchange, 80 E. Jackson Blvd.
CHICAGO

ARMCO Culverts in Railway Service

No. 24 of a Series

Name of Railway: Tennessee, Alabama & Georgia Railroad.

Location: Original installation at Cassandra, Ga. Present location near Mile Post 59 on same road.

Traffic: Light to medium railway traffic.

Installation Data: A 14-gauge, 36-inch ARMCO Culvert installed in 1910. Proving too small for its original location, the culvert was moved and installed in its present location under a 3 or 4-foot rock fill.

Condition: Excellent. Photographed and inspected June, 1922.

Remarks: Possibility of relocation is an added advantage of corrugated culverts.

There is a manufacturer in almost every state and in Canada, making Culverts, Flumes, Siphons, Tanks, Roofing, etc., of genuine, rust-resisting Armco Ingot Iron. Write for full information and nearest shipping point on products in which you are interested

ARMCO Ingot Iron

ARMCO CULVERT & FLUME MFRS. ASSN., Middletown, Ohio

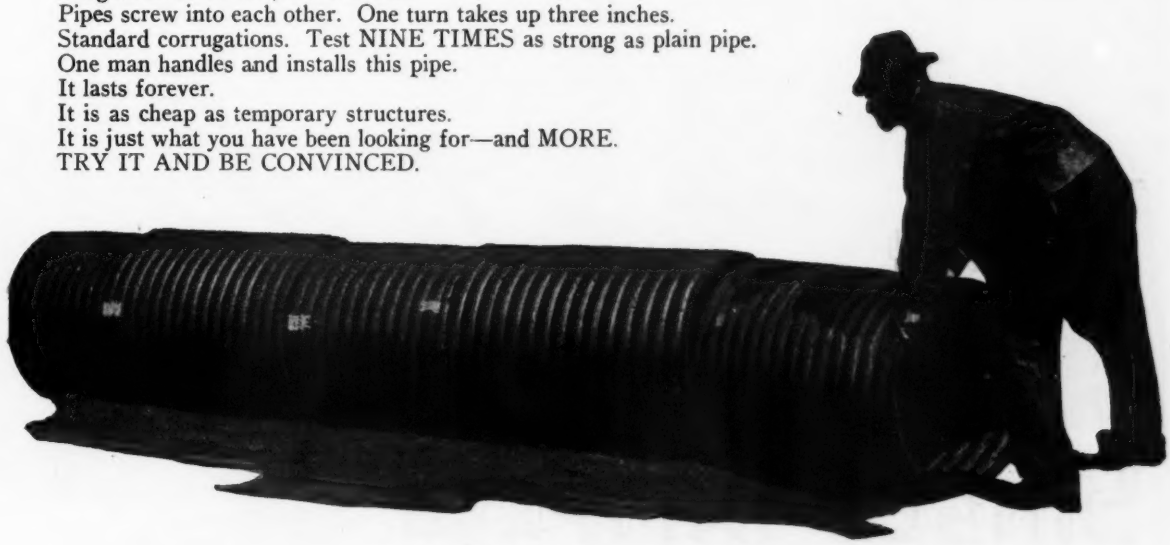
ARMCO CULVERTS

Introducing "THE MISSING LINK"

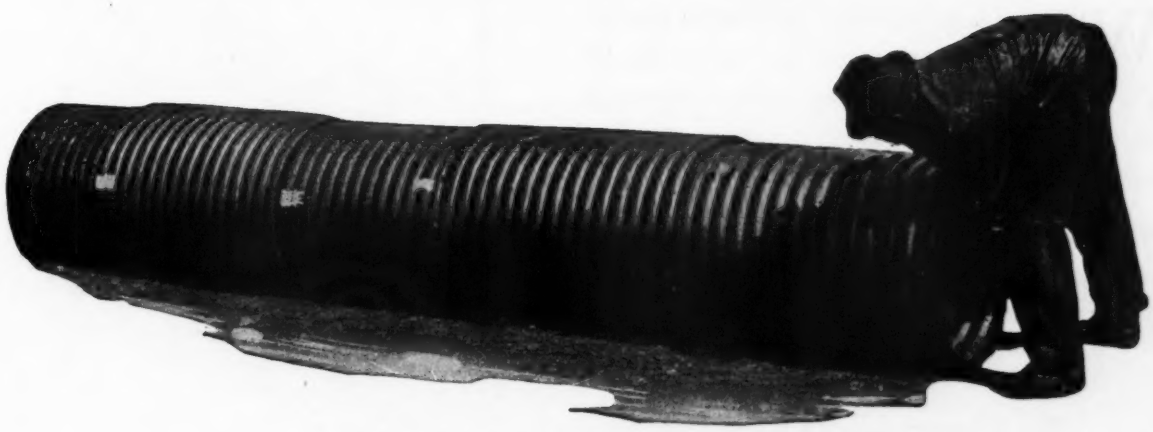
SPIRAL CORRUGATED CAST IRON CULVERT PIPE

Snappy Facts About It

Solid, round, vertically cast, pure remelted pig iron. *No scrap.*
Lengths of three feet, three inches.
Pipes screw into each other. One turn takes up three inches.
Standard corrugations. Test NINE TIMES as strong as plain pipe.
One man handles and installs this pipe.
It lasts forever.
It is as cheap as temporary structures.
It is just what you have been looking for—and MORE.
TRY IT AND BE CONVINCED.



Entering the Pipe by Rolling in on an Angle.



Screwing Pipe Together. One Turn Takes Up Three Inches

WE HAVE BEEN MAKING CAST IRON CULVERT PIPE FOR TWENTY YEARS

Write for Details and Prices

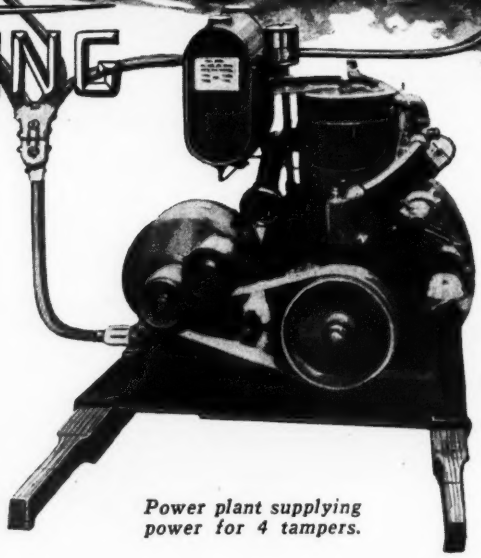
American Casting Company

Box 591 BIRMINGHAM, ALA.

SINGLE TAMPING

WITH the Jackson Electric Tie Tamper it is only necessary to tamp from one side of the tie. The 4000 even strokes applied to the ballast each minute, will tamp to a distance of from 12 to 14 inches ahead of the bar.

Single tamping doubles the number of ties that can be tamped within a given time. Track so tamped holds up under heavy traffic.



Power plant supplying power for 4 tampers.

The 4-Tamper capacity Power Plant supplies the necessary power for work of this character, as well as for track saws, track drills, tool grinders and flood lighting. Its portability makes its use desirable.

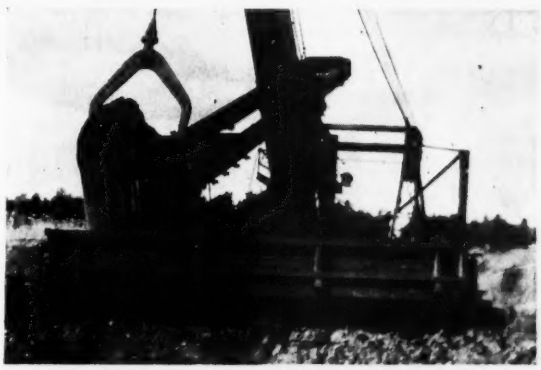
Let us show why many large roads are using this equipment.

ELECTRIC TAMPER & EQUIPMENT CO.

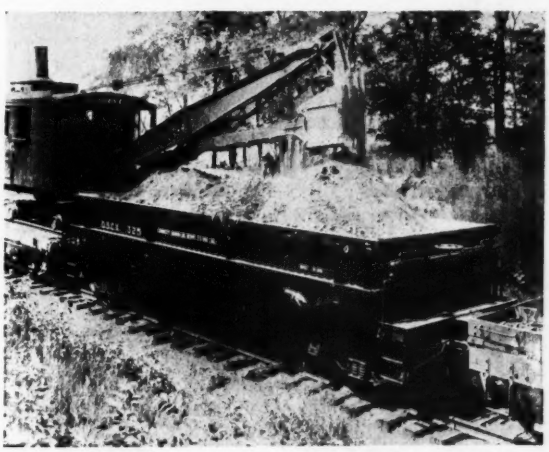
RAILWAY EXCHANGE CHICAGO, ILLINOIS

Dumping action quick and sure. Impetus given to load without destructive shock. Dumps well away from track.

The dumping operation complete. Dumps clean. Has clear discharge opening and steep dumping angle.



Constructed to withstand the severest service. Car being loaded with eight-yard dipper.



Standard ditcher loads 24 cu. yd. Car full length (crown load 35 cu. yds.)

THE DIFFERENTIAL AIR DUMP CAR

Possesses all the desirable features of previous dump car designs, and in addition has

NINE EXCLUSIVE FEATURES

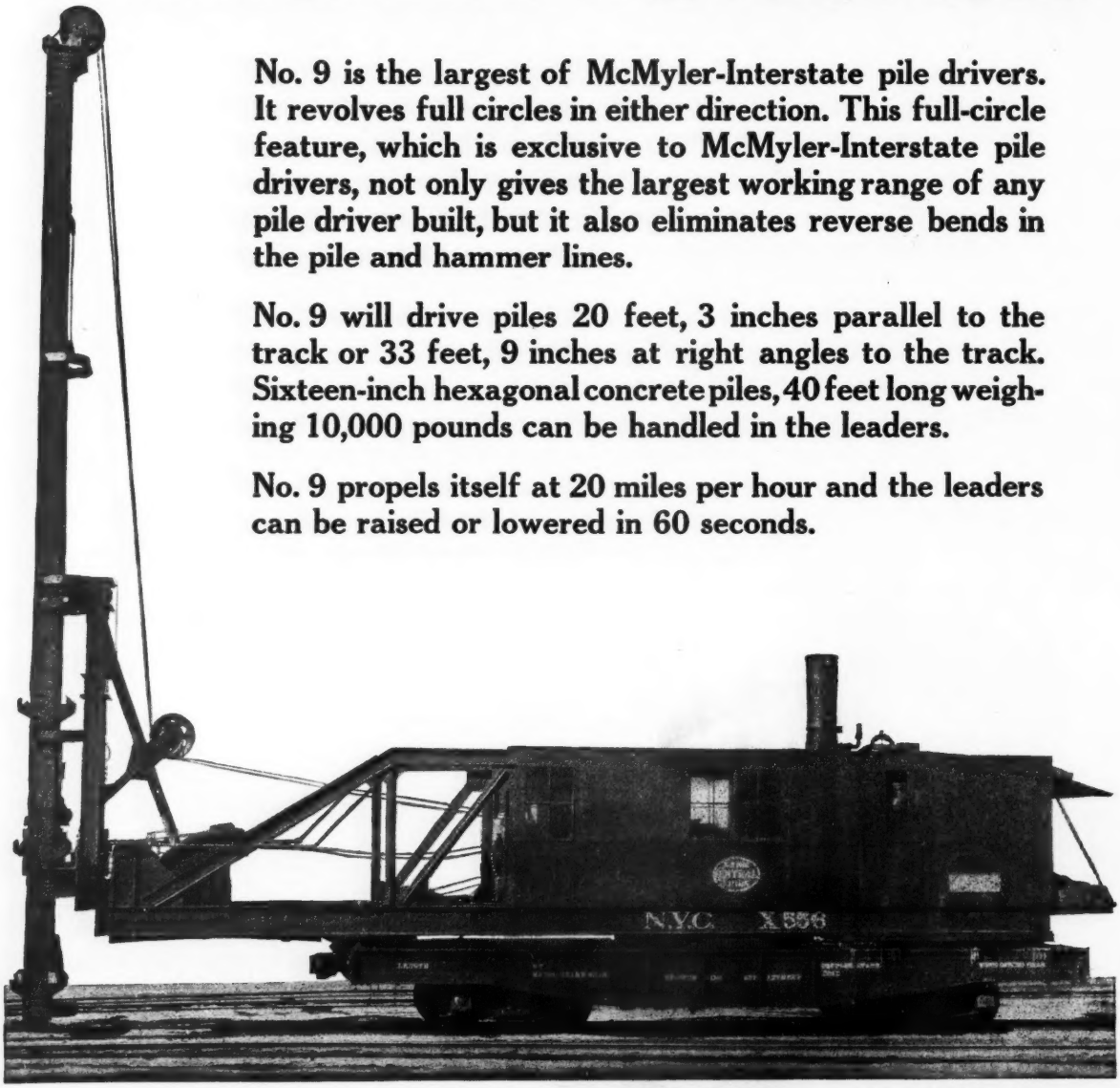
any one alone enough to place it high above any other dump car both in performance and construction.

These nine exclusive features are clearly explained in our Bulletin D-15. It will be sent to you or to any of your men upon request.

THE DIFFERENTIAL STEEL CAR CO.
FINDLAY, OHIO

No. 9- a Full Circle Pile Driver

WITH A SIDE REACH OF 33 FEET, 9 INCHES



No. 9 is the largest of McMyler-Interstate pile drivers. It revolves full circles in either direction. This full-circle feature, which is exclusive to McMyler-Interstate pile drivers, not only gives the largest working range of any pile driver built, but it also eliminates reverse bends in the pile and hammer lines.

No. 9 will drive piles 20 feet, 3 inches parallel to the track or 33 feet, 9 inches at right angles to the track. Sixteen-inch hexagonal concrete piles, 40 feet long weighing 10,000 pounds can be handled in the leaders.

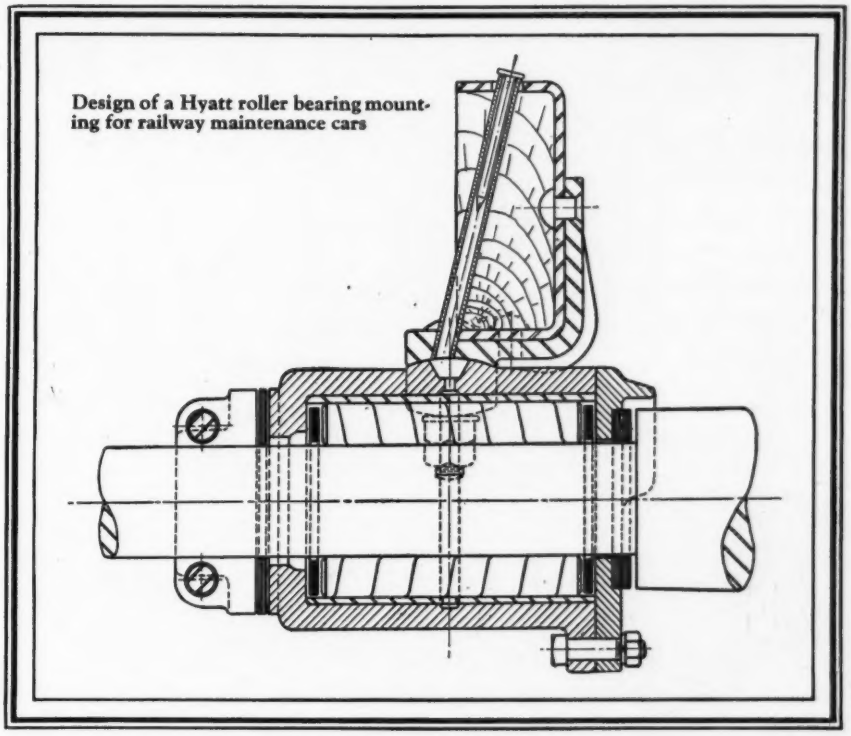
No. 9 propels itself at 20 miles per hour and the leaders can be raised or lowered in 60 seconds.

Locomotive Cranes • Power Shovels • Crawler and Tractor Cranes • Clam-shell Buckets
Orange-peel Buckets • Structural Steel • Car Dumpers • Pile Drivers • Railroad Equipment
Forgings • Coal and Ore Bridges • Barge Cranes • Wharf Cranes • R. R. Turntables

PD-9

McMyler-Interstate

NEW YORK BUFFALO PHILADELPHIA PITTSBURGH CLEVELAND DETROIT CHICAGO SAN FRANCISCO



Design of a Hyatt roller bearing mounting for railway maintenance cars

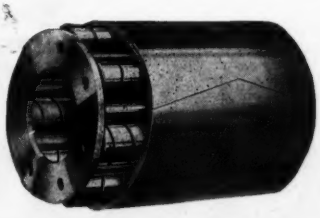
Reduce Costs—Insure Reliability *In Maintenance Car Operation*

THE cost of operating maintenance cars and the character of service rendered by them are largely dependent on one factor—the car bearings.

Leading car builders have adopted Hyatt roller bearings as best meeting the requirements of this class of service. Their uniformly easy rolling action, their positive oil-conserving lubrication and their rugged durability have proved to be a sure means to operating economies and to dependable performance under all conditions.

Hyatt equipped cars roll easily, saving fuel and man power. They are equal to the demands of hard use and overloading. The bearings require no attention other than oiling once every three or four months—no adjustments, repairs or replacements.

It is not necessary to wait until you need new cars to obtain these advantages. Hyatt bearing replacement boxes for converting your present plain bearing cars are furnished by the car builders. Ask them for complete information.



Hyatt bearings are furnished for all classes of railroad equipment. Ask for information on passenger cars, freight cars, locomotive tenders and turntables.

HYATT ROLLER BEARING COMPANY

NEWARK DETROIT CHICAGO SAN FRANCISCO
WORCESTER PHILADELPHIA CHARLOTTE
PITTSBURGH CLEVELAND

HYATT ROLLER BEARINGS FOR RAILWAY MAINTENANCE CARS

Guarantee
Owen Buckets, properly installed and operated, are guaranteed to do a bigger day's work than any other bucket of the same weight and capacity—
—or—
Write your own guarantee!
THE OWEN BUCKET CO.

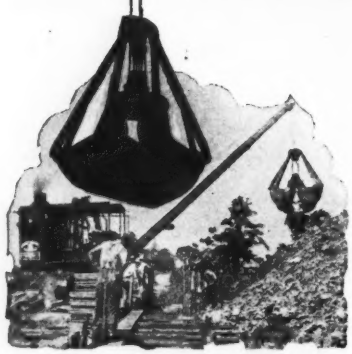
A Mouthful at Every Bite

Centuries ago, in the wilds of western North America, the *triceratops* slowly plodded his way, ever onward—ever in search of prey.

This forbear of the modern rhinoceros held in his giant jaws an attack of crushing strength that brought him a mouthful at every bite.

And, too, an Owen Bucket possesses in its jaws of tremendous strength, a force that tears material from pile or ground—quickly and efficiently. Because of its scientific design and construction—in strict conformance to requirements under actual working conditions—the Owen Bucket outrivals the brute ability of the ruler of dinosaurs.

The story of Owen Buckets is told and illustrated in an interesting folder, which is yours for the asking. We'll send it promptly.



Excavating stiff blue clay with one-yard Type "D" Digging Bucket. One of three owned by D. W. Thurston Co., Detroit.

The OWEN BUCKET Co.

1005 Rockefeller Building Cleveland, Ohio

Baltimore Chicago Dallas Los Angeles Minneapolis Philadelphia
Pittsburgh New York Miami Portland St. Louis San Francisco

OWEN CLAMSHELL BUCKETS INSURE A BIGGER DAY'S WORK

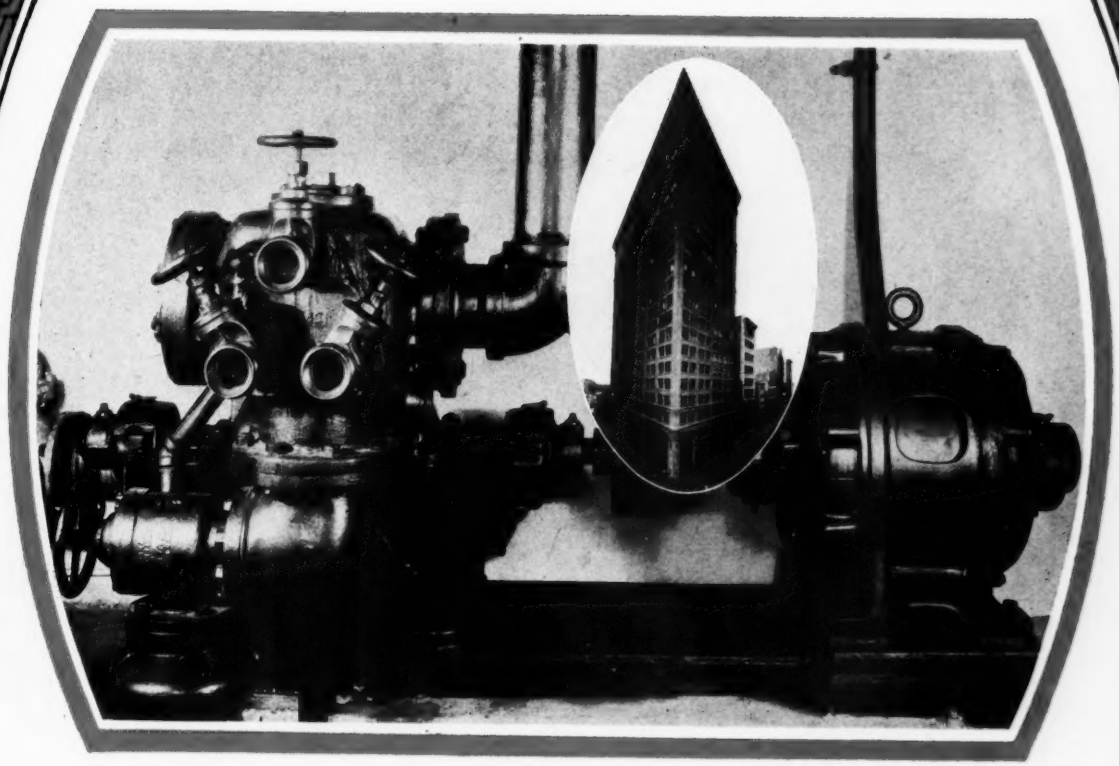
Owen Buckets

INSURE A BIGGER DAY'S WORK

© O. B. Co.

AMERICAN

AURORA, ILL.



FRANKLIN Trust Building, in Philadelphia, depends upon a 6-inch two stage "American" 750 gallon Fire Underwriter Centrifugal Pump for its fire protection.

This pump is designed for 100-pound pressure and is driven by 75 H. P. motor.

For drainage purposes an "American" Duplex Sump Pump unit, consisting of two vertical 2-inch single stage pumps has been installed. Each of these pumps has a capacity of 135 G. P. M. at 35-foot head. There has also been installed two "American" 3-inch two stage centrifugal house pumps which are operated by 30 H. P. motors to give 175 G. P. M. at 286-foot head.

The hydraulic design of a large modern building calls for unusually reliable pumps. Make sure they bear the "American" name-plate!

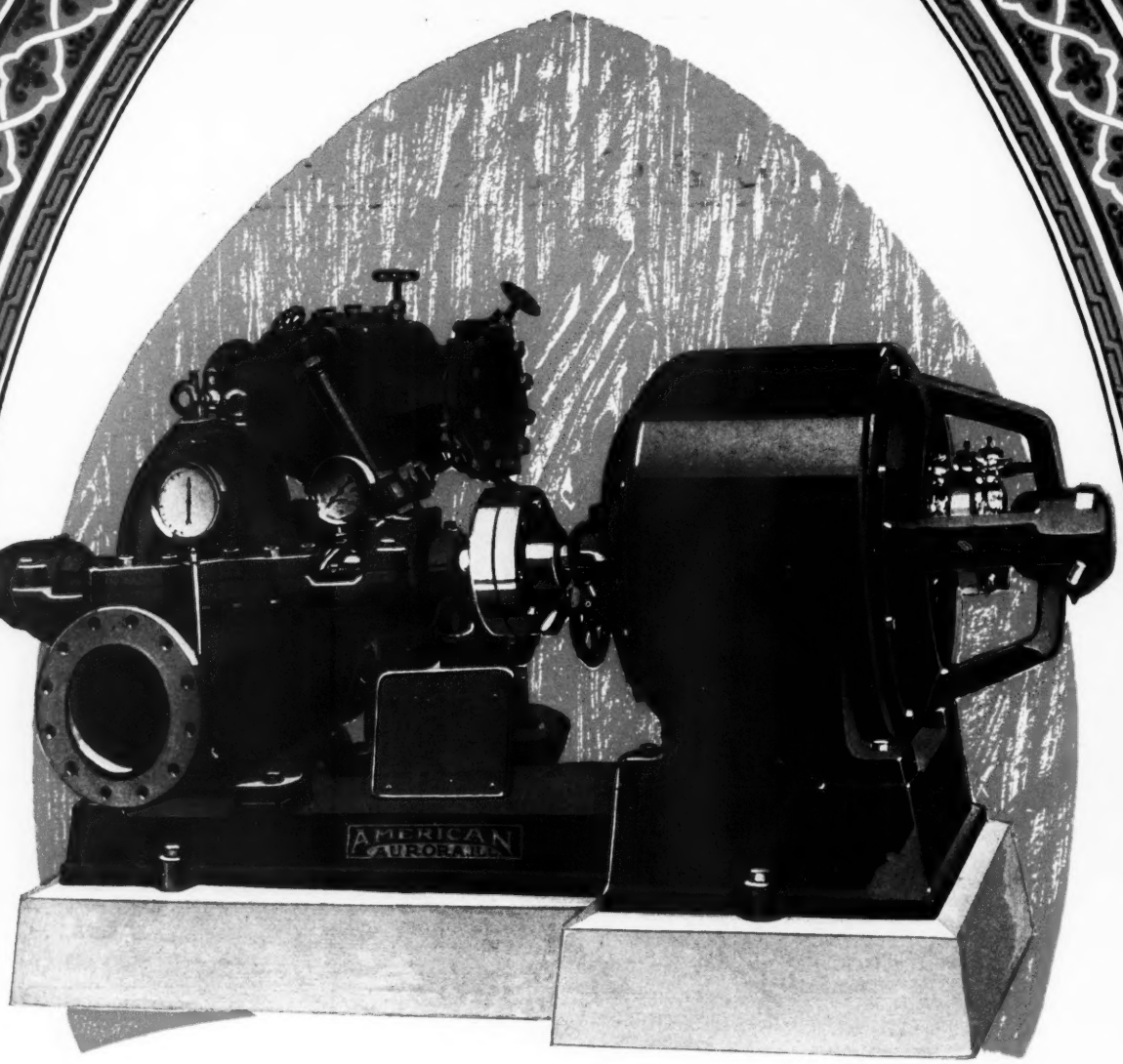
GENERAL OFFICES AND WORKS - AURORA, ILL.

THE AMERICAN WELL WORKS

NEW YORK, N. Y. . . . . 165 BROADWAY
MILWAUKEE, WISC. FIRST WISC. NAT. BANK BLDG.

BRANCH OFFICES

CHICAGO, ILL. FIRST NATIONAL BANK BLDG.
DALLAS, TEXAS. . . . . WESTERN INDEMNITY BLDG.
SAN FRANCISCO, CALIF. . . . . 635 MISSION STREET



"American" Fire Protection!

"AMERICAN" Fire Pumps are approved by the National Board of Fire Underwriters and are subject to their continual inspection.

"American" single stage Underwriter Pumps are designed for 750 G. P. M.; 1000 G. P. M. and 1500 G. P. M. capacities at 100 pounds pressure.

"American" two stage Underwriter Pumps are designed for 500 G. P. M.; 750 G. P. M. and 1000 G. P. M. capacities at 100 pounds pressure.

"American" Fire Pumps are all approved by the National Board of Fire Underwriters and are subject to their continual inspection, and are furnished complete with specification Underwriter's fittings, or without.

All Pumps are bronze fitted and designed in accordance with the specifications of the National Board.

"American" Fire Pumps not only afford ample fire protection but are often a means of reducing insurance rates.

Bulletins and engineering information available for the asking!

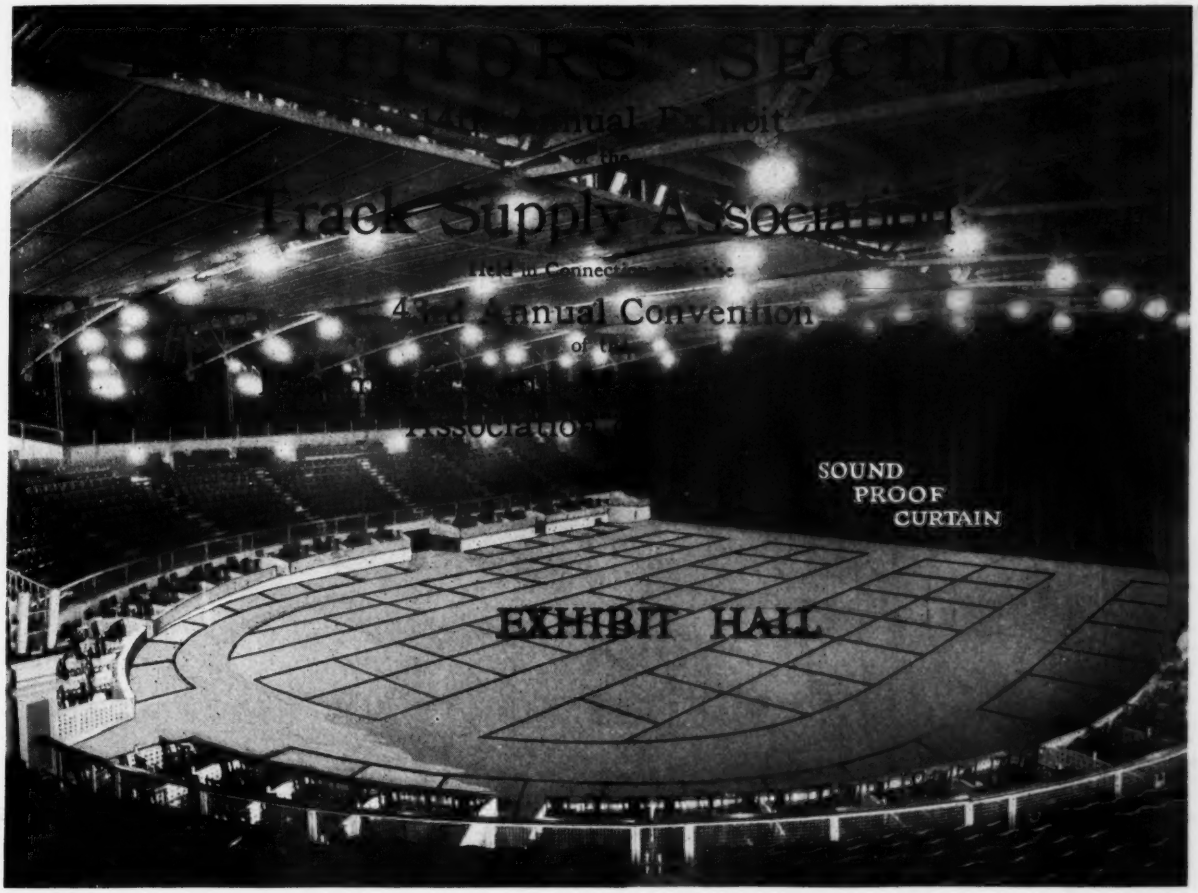
GENERAL OFFICES AND WORKS - AURORA, ILL.

THE AMERICAN WELL WORKS

NEW YORK, N. Y. . . . . 165 BROADWAY
MILWAUKEE, WISC. . . FIRST WISC. NAT. BANK BLDG.

BRANCH OFFICES
CHICAGO, ILL. FIRST NATIONAL BANK BLDG.

DALLAS, TEXAS. . . . . WESTERN INDEMNITY BLDG.
SAN FRANCISCO, CALIF. . . . . 635 MISSION STREET



The Convention Sessions Are Held in the Hall Which Is Cut Off from the Exhibits by the Sound Proof Curtain

In the following special section are grouped pages descriptive of railway track supplies, equipment and materials exhibited at Kansas City during the Convention, September 22, 23, 24, 1925.

EXHIBITORS REPRESENTED IN THIS SECTION

American Valve & Meter Company ..... 23 and 44
Bethlehem Steel Company 34
Buda Company 39
Duff Manufacturing Company 36
Fairbanks, Morse & Company ..... 29 and 30
Fairmont Railway Motors, Inc. 33
Fleming & Sons Company, Inc., J. R. 38
Hackmann Railway Supply Company 31
Ingersoll-Rand Company 43
Jordan Company, O. F. 40
Kalamazoo Railway Supply Company 35
Lundie Engineering Corporation 41
Mechanical Manufacturing Company 42
National Lock Washer Company ..... 24 and 25
Northwestern Motor Company 37
Oxweld Railroad Service Company 28
P & M Company 22
Rail Joint Company 46
Ramapo Ajax Corporation 26
Western Wheeled Scraper Company 27
Wharton, Jr., & Company, Inc., William 32
Woolery Machine Company 45

Dependable RAIL ANTI-CREEPERS

The FAIR

RAIL ANTI-CREEPER
Economical - Efficient
and
So easy to apply

CHICAGO THE P. & M. CO. NEW YORK

MONTREAL LONDON PARIS CALCUTTA SYDNEY

Absolute Main Line Switch Safety

insured with

THE ANDERSON *switch* INTERLOCKER

The ANDERSON Switch INTERLOCKER prevents the switch from opening under traffic, should the switch stand be damaged or destroyed by accident. **It is not a part of the switch stand.**

It prevents the switch from opening under traffic, should any part of the switch mechanism become disengaged or fail when the switch is closed and locked for the main line.

The switch **must be properly** closed in order to apply the padlock.

The interlocking is **automatic** when the switch is properly closed.

Can be applied to **any** switch and used with **any** switch stand.

Write for complete literature.

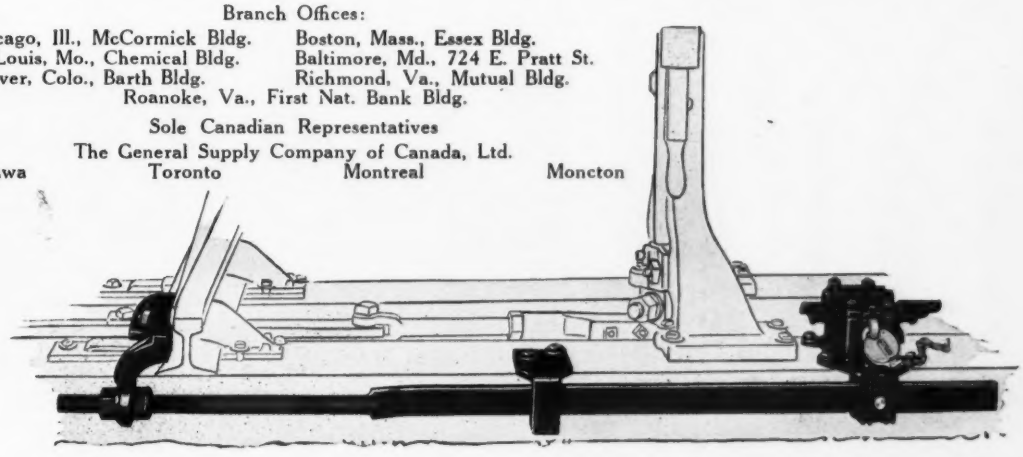
Manufactured exclusively by

THE AMERICAN VALVE & METER CO., Cincinnati Ohio, U. S. A.

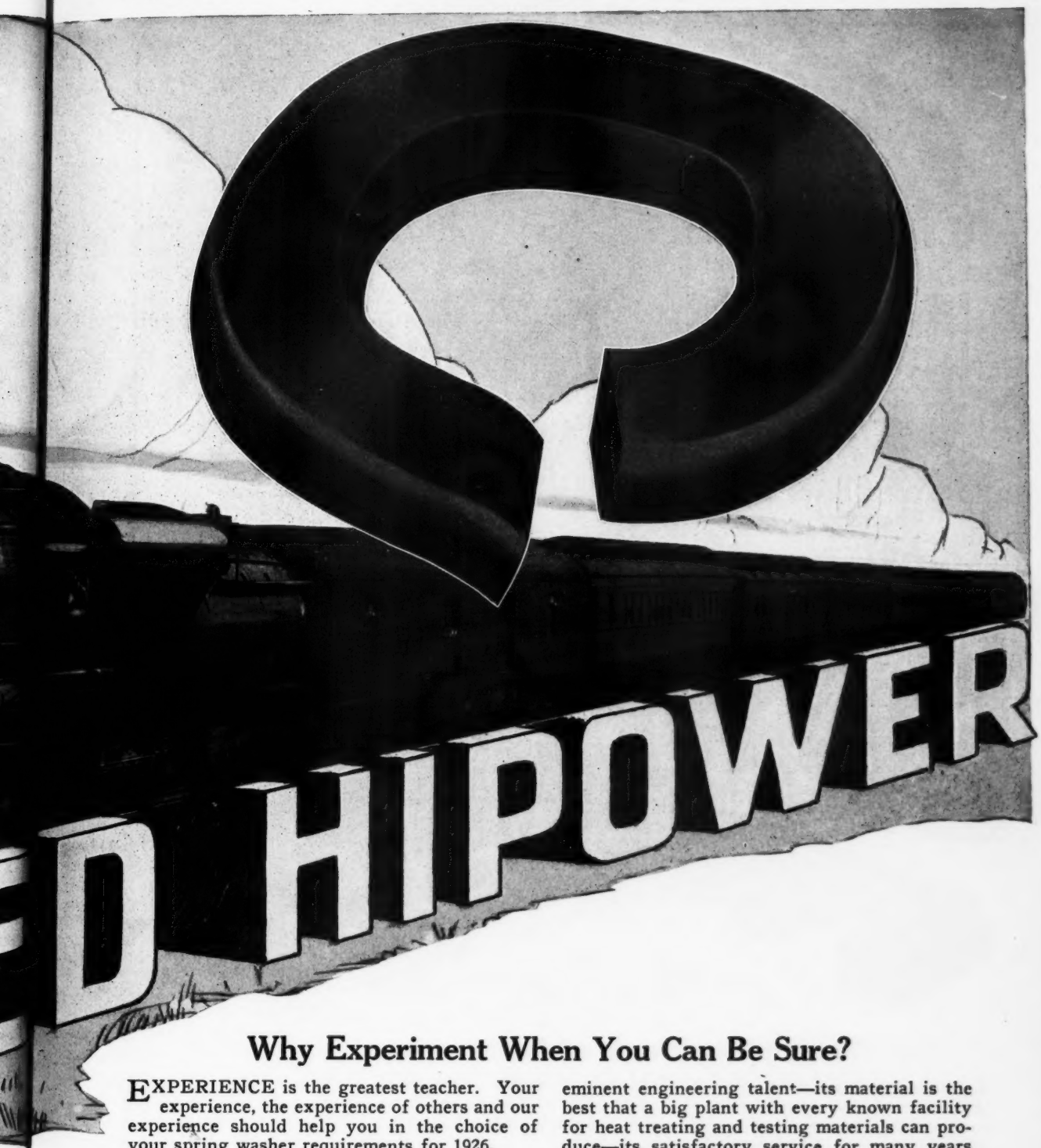
Branch Offices:

Chicago, Ill., McCormick Bldg. Boston, Mass., Essex Bldg.
St. Louis, Mo., Chemical Bldg. Baltimore, Md., 724 E. Pratt St.
Denver, Colo., Barth Bldg. Richmond, Va., Mutual Bldg.
Roanoke, Va., First Nat. Bank Bldg.

Sole Canadian Representatives
The General Supply Company of Canada, Ltd.
Ottawa Toronto Montreal Moncton



A Solid Foundation for the Permanent Security of Railway Track Joints



Why Experiment When You Can Be Sure?

EXPERIENCE is the greatest teacher. Your experience, the experience of others and our experience should help you in the choice of your spring washer requirements for 1926.

We believe (and our 40 years' experience makes our belief worthy of consideration) that IMPROVED HIPOWER is the highest development in spring washer design and manufacture.

Its design is the product of this country's most eminent engineering talent—its material is the best that a big plant with every known facility for heat treating and testing materials can produce—its satisfactory service for many years has resulted in its standardization by most of the leading Railroad systems.

IMPROVED HIPOWER takes the experiment out of keeping track joints tight—it keeps them tight—it has proved its worth.

The National Lock Washer Co.

Newark, N. J., U. S. A.

RACOR

SEVEN WORKS
RAMAPO-AJAX-ELLIOT
HILLBURN, NEW YORK
NIAGARA FALLS, N.Y.
CHICAGO, ILLINOIS
EAST ST. LOUIS, ILL
PUEBLO, COLORADO
SUPERIOR, WISCONSIN
NIAGARA FALLS, CANADA

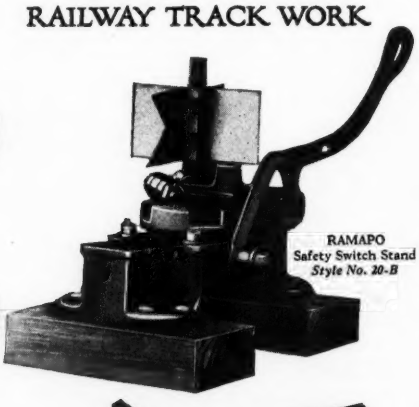
HEAVY DUTY HEAT TREATED GUARD RAIL CLAMPS
DROP FORGED RAIL BRACES
ADJUSTABLE RAIL BRACES
EUREKA ADJUSTABLE CLIPS
MANGANESE REINFORCED SWITCH POINTS
RAMAPO AUTOMATIC SAFETY SWITCH STANDS
AJAX MANGANESE ONE-PIECE GUARD RAILS
SWITCHES – FROGS
CROSSINGS – SPECIAL
RAILWAY TRACK WORK

RACOR
Heat Treated Heavy
Duty Guard Rail Clamp

RAMAPO
Safety Switch Stand
Style No. 17

RACOR
Adjustable
Rail Brace

RACOR
Drop Forged
Rail Brace


RAMAPO
Safety Switch Stand
Style No. 20-B

AJAX MANGANESE
One-Piece
Guard Rail

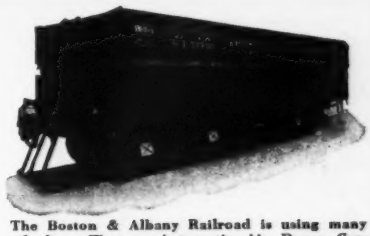
EUREKA ADJUSTABLE
Open Side Switch Clip

RACOR
TRADE MARK
REGISTERED

Main Office – HILLBURN, NEW YORK
SALES OFFICES AT WORKS, ALSO
30 CHURCH STREET, NEW YORK
McCORMICK BUILDING, CHICAGO

RAMAPO AJAX CORPORATION

RENT Westerns
Charge to Maintenance



The Boston & Albany Railroad is using many of these Western Automatic Air Dump Cars with aprons for distributing locomotive cinders along the roadbed.

Roadmasters and Maintenance Men

YOU long have wanted Western air dump cars. We offer you the opportunity of RENTING them with an option to purchase. If your board will not pass an A. F. E. for dump cars, rent what Westerns you need and charge the outgo to maintenance. You know that the saving over the cost of hand-shoveling will be enormous and will justify the charge. Sizes from 12 to 45 cubic yards, capacity 60,000 to 140,000 pounds. Equipped with aprons when desired, in order to throw the load outside the ballast.

Western

Yours for greater economy

Western Wheeled Scraper Company

Founded 1877

Earth and Stone Handling Equipment

AURORA, ILLINOIS

THE OXWELD RAILROAD SERVICE COMPANY

representing

THE LINDE AIR PRODUCTS CO.
(Linde Oxygen)

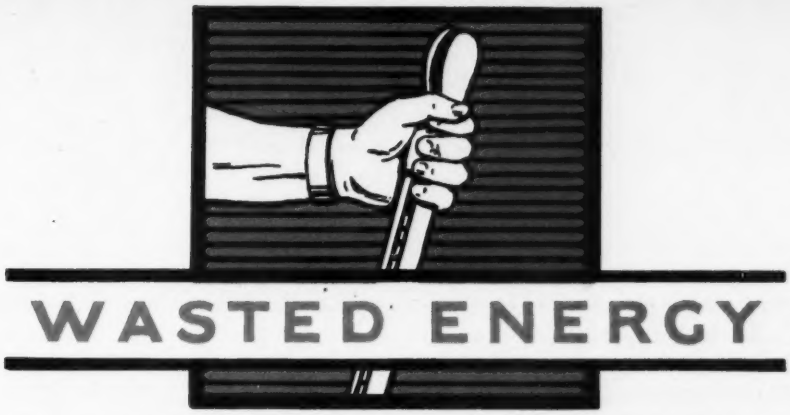
THE PREST-O-LITE CO., Inc.
(Prest-O-Lite Acetylene)

UNION CARBIDE SALES CO.
(Union Carbide)

OXWELD ACETYLENE CO.
(Oxweld Apparatus and Supplies)

Railway Exchange
Chicago

30 East 42d Street
New York



WASTED ENERGY

Avoided in the new Sheffield 44

The energy wasted in tugging at a tension lever—the energy wasted in making belt repairs—the energy wasted between the engine and the wheels—these are the losses that are eliminated in the Sheffield 44 one-cylinder water cooled motor car.

Here is a car with a positive *chain drive,* perfectly controlled by a clutch that is velvety in action but positive when fully engaged. It is a clutch that can't be burned out. Slip it as much as you want. The cooling fins which dissipate the heat and the other finely worked out details of design make it equal to the roughest treatment.

This clutch-controlled chain drive eliminates the sliding engine base and the troubles that go with it. It permits locating the driving sprocket close to the flywheel so that there is little stress on the crankshaft. Moreover, the stress on the crankshaft in a chain driven car is a *known* stress that does not vary—a stress that can be definitely provided for in construction.

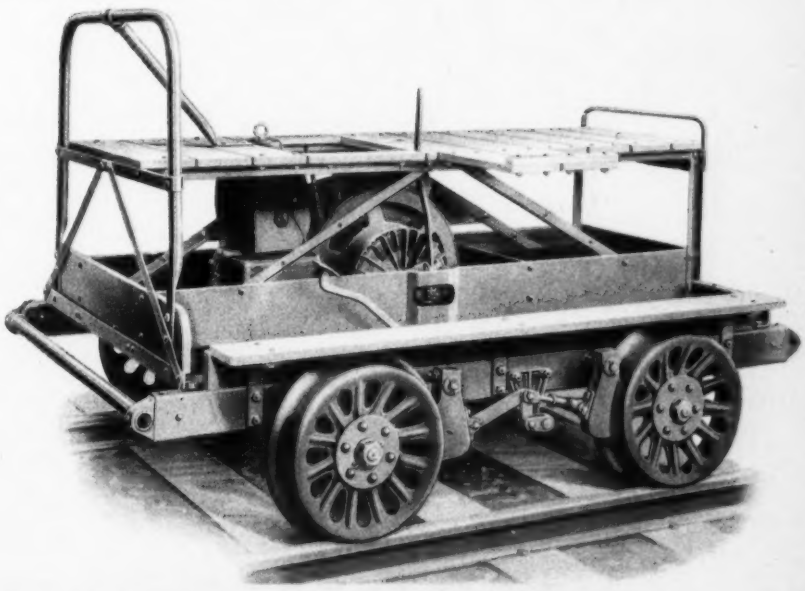
In addition to this advanced drive the Sheffield 44 has many other features that have made it the leader in its class. The highly perfected engine is fully accessible. The frame is pressed steel, automobile type. The car is exceptionally light considering its rugged construction.

Remember the "44" is simply one of the many Fairbanks-Morse Section Cars that have been blazing the trail of motor car development for more than thirty years.

The two-cylinder "40-B" is described on the next page.

FAIRBANKS-MORSE *was*
FIRST*

*To build a center-load car
*To use a water-cooled engine
*To use a gear drive
*To use a chain drive
*To use a free-running engine
*To use a clutch drive
*To use a two-cycle engine
*To use a pressed steel frame
*To use wood center wheels
*To use pressed steel wheels
*To use a self-priming engine



FAIRBANKS-MORSE
MOTOR CARS

First on the Rails —*and still first*

A793

Ever-popular—now greatly improved

The Sheffield 40-B is simply an improved model of the former Sheffield 40—a still finer model of a car that has always been held in highest favor.

The new car preserves the many excellent features of the former model, but is more highly developed in every detail. The engine now represents the sum-total of all that is best in automotive practice. The crankshaft is mounted on Timken Bearings, which absorb the thrust of the greatly simplified friction transmission. Three-point suspension of the engine insures perfect alignment.

Absolute rigidity is made a certainty by the use of the new automobile-type pressed steel frame—probably the strongest frame ever used on a car of this type. The axles turn in Timken Taper Bearings which absorb the thrust and radial loads, preventing the cutting of the axles.

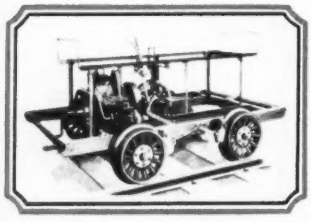
In every respect you will find the new "40-B" a worthy representative of Fairbanks-Morse motor cars that have held a position of leadership in their field for more than thirty years.

One of our representatives will be glad to give you complete information covering any of the wide line of Fairbanks-Morse motor cars. Or ask for bulletin information.

COALING STATIONS

The finest of equipment backed by undivided responsibility permanently guarantees every coaling station that is

Built throughout
by
FAIRBANKS-MORSE

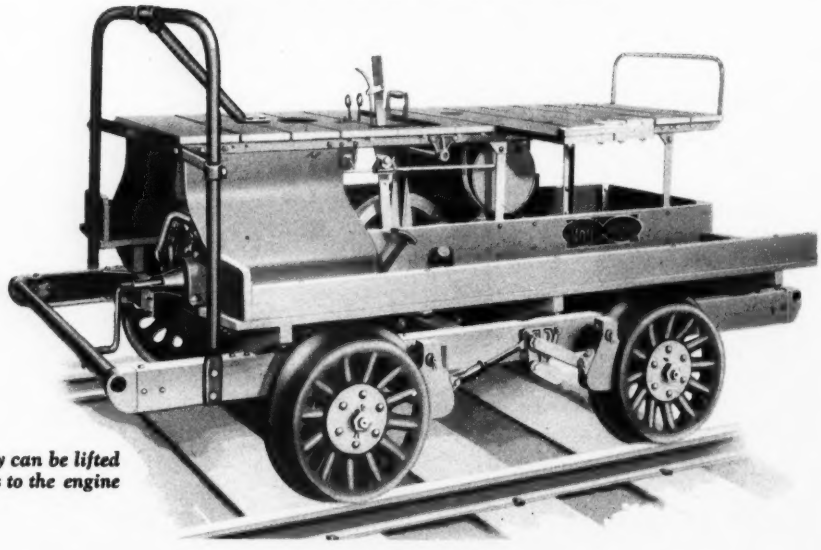


Note the rugged automobile-type pressed steel frame and the wide decks with raised sills for retaining tools

FAIRBANKS, MORSE & CO., *Chicago*

Manufacturers of railway motor cars, hand cars, push cars, velocipedes, standpipes for water and oil, tank fixtures, oil engines, steam, power and centrifugal pumps, scales, complete coaling stations

24 branches in the United States, each with a service station



By taking out four bolts the entire body can be lifted free from the chassis, giving full access to the engine and driving mechanism

FAIRBANKS-MORSE MOTOR CARS

First on the Rails —*and still first*

HACKMANN COMBINATION TRACK LINER

SAVES 60% OF YOUR LABOR AND TOOL COST

HACKMANN Track Liners Will Line Track, Frogs, Switches, Space Ties, Raise Low Joints, Without Disturbing the Road Bed. No Digging Necessary

60% Labor Cost Saved

3 Men With Hackmann Track Liners Do the Work That Required 9 to 12 Under the Old Method Hackmann Track Liners Will Pay For Themselves By the Saving in Labor Cost

NO. 1 LINING BAR

HACKMANN COMBINATION LINING BARS

(VERONA MADE—HEAT TREATED)

The No. 1 lining bar with chisel end and the No. 2 combination tamping and lining bar are drop forged from special steel specially tempered with 1-inch drop forged lugs as an integral part of the bars, for use with Hackmann bases.
Tests on different roads have proven conclusively that the new Hackmann Combination Track Liner gives more than double the efficiency of any liner now on the market.

DEMONSTRATIONS

We Will Gladly Demonstrate the Efficiency of This Equipment Upon Request

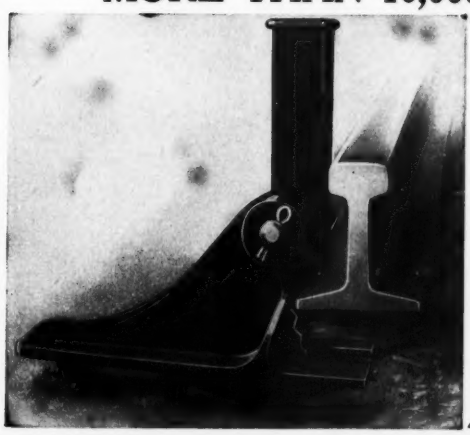
NO. 2 TAMPING AND LINING BAR

NOTE THE TWO STEP FEATURE AT TOP OF BASE

You can make at least two pulls without resetting the liner. Just move the bar to the top notch.

Weight 20 lbs.

MORE THAN 10,000 OF OUR LINERS NOW IN USE



The IDOL TRACK LINER

NOW IN USE ON 90 RAILROADS

The Idol Track Liner will line track frogs, switches, space ties, raise low joints without disturbing the road bed as no digging is necessary. They will pay for themselves every day by work you will be able to do with a few men. They will save you 50% in labor costs.

The Idol Track Liner can be operated with any ordinary lining bar.

THE HACKMANN RAILWAY SUPPLY CO.

RAILWAY SAVING DEVICES
723 So. Wells St., CHICAGO, ILLINOIS

VERONA TOOL WORKS
New York, N. Y. Boston Mass.
Washington, D. C. Verona, Pa.
San Francisco, Cal.

FREDERICK HACKMANN,
President and Mechanical Engineer

LAUGHLIN & CHENEY
Chicago, Ill.
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St. Louis

BALDWIN LOCOMOTIVE WORKS
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WM. ZEIGLER CO.
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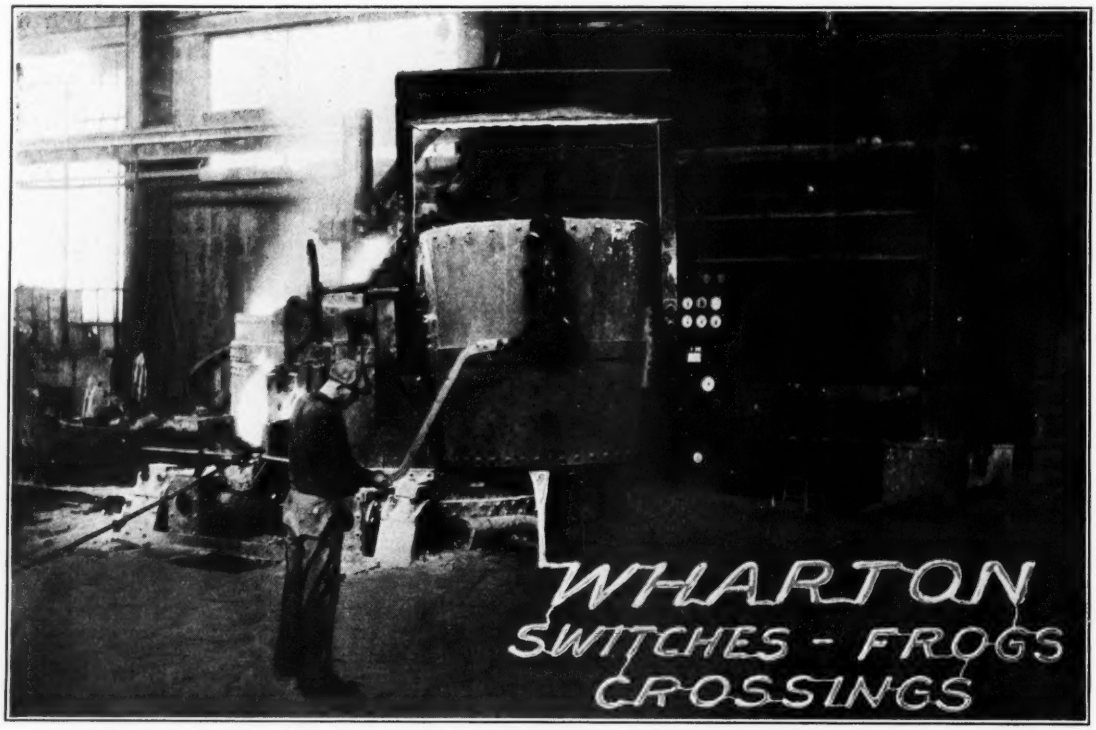
J. J. FRANZEN,
Secretary and Treasurer

THE HOLDEN CO. Ltd., Canada
Toronto Montreal Winnipeg
Vancouver

SEE OUR APPLIANCES ON EXHIBITION AT BOOTH NO. 22 OF THE TRACK SUPPLY ASSOCIATION EXHIBIT, HELD IN CONJUNCTION WITH THE ROADMASTERS' AND MAINTENANCE OF WAY ASSOCIATION OF AMERICA, TO BE HELD AT KANSAS CITY, MO., SEPTEMBER 22, 23 AND 24.



For Maximum Service at Minimum Cost
WHARTON TRACKWORK

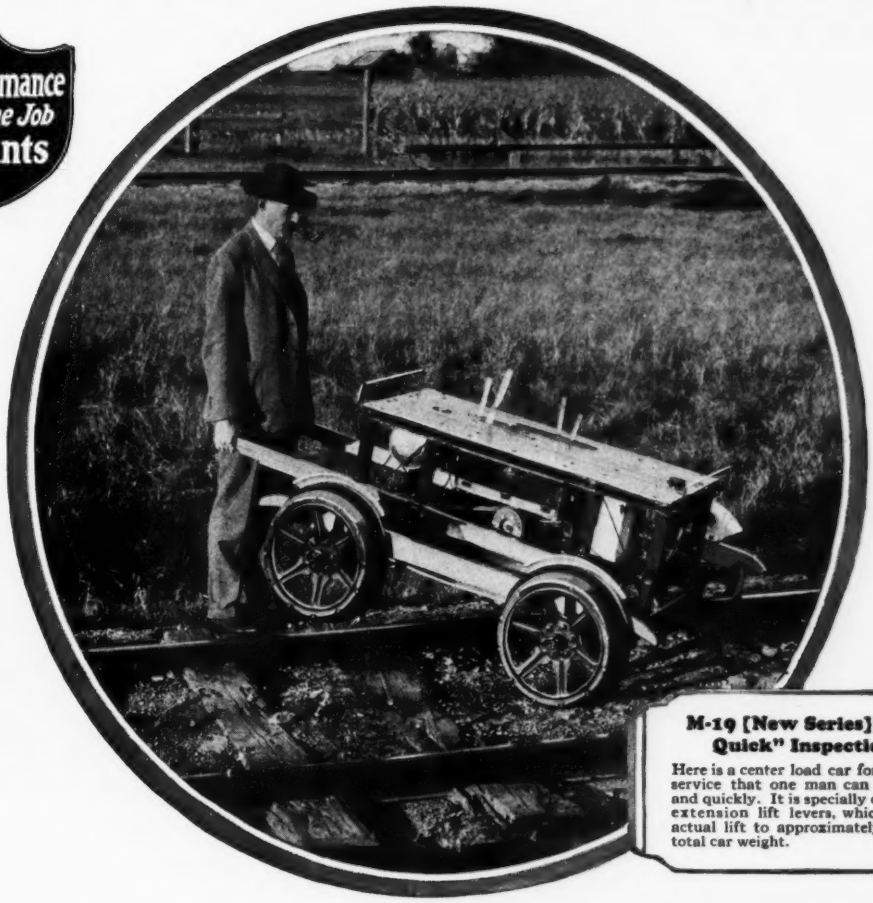
No matter how difficult your problems may be, no matter how severe the conditions, Wharton Special Trackwork with Switches, Mates, Frogs and Crossings of ***TISCO*** Manganese Steel will give you the service you want at minimum cost.

Sales Offices:

San Francisco . . . Cal.
Chicago . . . . . Ill.
El Paso . . . . . Tex.
Boston . . . . . Mass.
Pittsburgh . . . . . Pa.
Scranton . . . . . Pa.
New York . . . . . N. Y.
Philadelphia . . . . . Pa.

Wm. Wharton Jr. & Co., Inc.
Originators of Manganese Steel Trackwork
Easton, Pa.

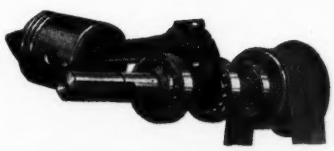
Performance on the Job Counts



M-19 [New Series] "Safety-Quick" Inspection Car

Here is a center load car for extra heavy service that one man can handle easily and quickly. It is specially equipped with extension lift levers, which reduce the actual lift to approximately 25% of the total car weight.

"Originated by Fairmont!"



Three-Bearing Ball-Bearing Crankshaft

Ball-bearing crankshaft supported on three bearings instead of two. Note how all pulley-over-hang is overcome by the third or end bearing (at right). Holds pulley in perfect alignment. Prevents crystalizing of steel shaft, and breakage. The only safe and wholly efficient crankshaft mounting.

SPECIALIZED knowledge of motor car manufacture gained from years of careful research and experience underlies every Fairmont improvement.

Every new feature before adoption must prove its fitness not only as a unit but as a perfectly coordinating part of the entire motor car assemblage.

Strict adherence to this policy has kept Fairmont far ahead in the development of safe, economical and dependable motor cars. And the list of items of motor car construction, "originated by Fairmont" grows steadily larger and larger!

FAIRMONT RAILWAY MOTORS, Inc.
Fairmont, Minnesota

DISTRICT SALES OFFICES:
New York Chicago St. Louis San Francisco Washington, D. C. Winnipeg, Canada

Fairmont

Ball-Bearing Engines and Railway Motor Cars

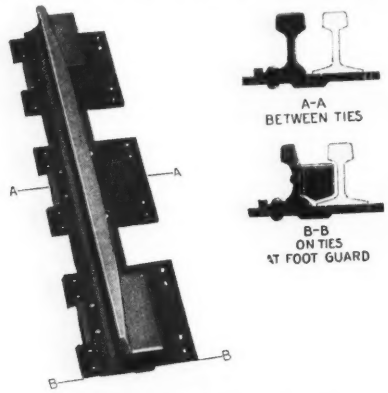
Bethlehem Track Specialties

Bethlehem Gage Rod, Design 855

Non-Insulated Type

The Bethlehem Adjustable Gage Rod is used on curves, at the toe and heel of switches, on bridges and on any track difficult to hold to gage and line. End adjustment makes these rods quicker to install and easier to draw up than the old style non-adjustable rods, which require the pulling of all spikes to install. Bethlehem Gage Rods increase the life of ties and soon pay for themselves through eliminating respiking. They add life to the rails by maintenance of perfect gage and line.

The gage rod shown above is the non-insulated type, design 855—an insulated type rod is also made and is known as design 856.



Hook Flange Guard Rail, Design 750

Hook Flange Guard Rail, Design 750

Bethlehem Hook Flange Guard Rail, Design 750, is rolled with a depressed flange on one side which hooks under the base of the running rail its entire length, thus positively preventing overturning.

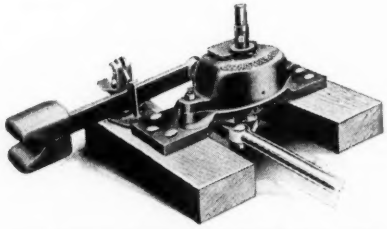
Three heavy two-tie base plates and the foot guards at each end are permanently attached, forming a complete unit ready for installation. No clamps, braces, tie plates, foot guards, filler blocks, or bolts are required.

Bethlehem Hook Flange Guard Rails are recommended for high speed main line as well as yard service. They are easily and quickly installed, can be adjusted for wear, and reduce maintenance charges to a minimum.

New Century Switch Stand

New Century Switch Stand is an adjustable stand, of parallel throw, and of heavy construction. The stand is positive when latched and automatic when unlatched. A patented lost motion action between the forged steel lug and the segment gear greatly assists hand operation and also improves operation when used automatically.

All parts are accurately machined to standard gages, insuring interchangeability with other New Century models.



New Century Switch Stand, Model 51-A with lamp plug top.

Parallel Throw Switch Stand, Model 1222

Model 1222 Switch Stand

Bethlehem Parallel Throw Switch Stand, Model 1222, is unusual with its low height, strength and simplicity. Low height and parallel throw lever make it particularly desirable for use in confined locations.

Bethlehem Model 1222 is built up of but three moving parts, is easy to throw, boltless and readily adjustable (range of adjustment, 3½ in. to 6 in.).

Other Bethlehem Track Specialties include Bolts; Frogs; Mates; Nuts; Pole Line Material; Rails, tee and girder; Spikes; Splice Bars; Switches; Tie Plates; Special Layouts and Trackwork.

Visit Bethlehem's Display at the Track Supply Assn. Exhibit, Kansas City, Mo., Sept. 22-24

BETHLEHEM STEEL COMPANY, *General Offices:* BETHLEHEM, PA.

District Offices:

New York Boston Philadelphia Baltimore Washington Atlanta Pittsburgh
Buffalo Cleveland Detroit Cincinnati Chicago St. Louis San Francisco

Bethlehem Steel Export Corp., 25 Broadway, New York City, Sole Exporter of our Commercial Products

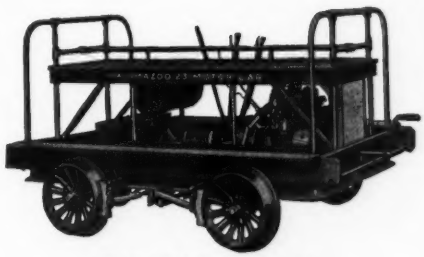
BETHLEHEM

KALAMAZOO MOTOR CARS

KALAMAZOO NO. 16
For Supervisors, Roadmasters, Signalmen and Linemen.

KALAMAZOO NO. 16-L
A light car for Inspection Service.

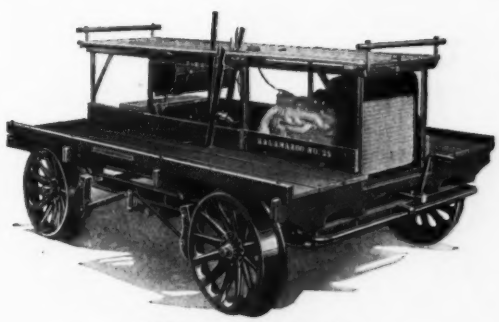
BETTER SERVICE



LOWER UPKEEP

KALAMAZOO NO. 23
For Heavy Section Work.

KALAMAZOO NO. 17
For ordinary Section Gang use.



KALAMAZOO NO. 25
For 12 to 24 men, Extra Gang Service and Construction Operation.

LOWER ULTIMATE COST

See our exhibit at Convention of Roadmasters' and Maintenance of Way Association, Kansas City, Mo., Sept. 22nd, 23rd, 24th—Space No. 9.

Railway Motor Cars
Gasoline Passenger Cars
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Electric Crossing Gates
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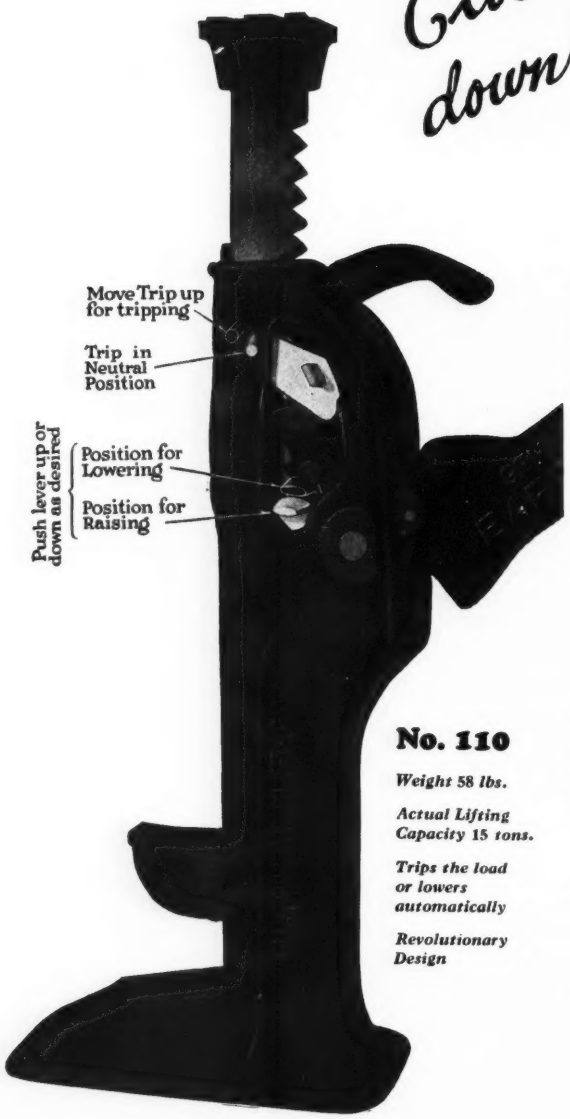
DUFF

THE DUFF MFG. CO. PITTSBURGH, PA.
BARRETT
SAFETY
TRACK JACK
TRIP & AUTOMATIC LOWERING JACK

Eliminates "fingering down" No Accidents—

Safe


Move Trip up for tripping
Trip in Neutral Position
Push lever up or down as desired
Position for Lowering
Position for Raising

No. 110

Weight 58 lbs.

Actual Lifting Capacity 15 tons.

Trips the load or lowers automatically

Revolutionary Design

Built at the suggestion of practical railroad men who wished to eliminate accidents to fingers in the usual fingering down operation of trip or track jacks.

The good old Barrett No. 1, with many important new features, such as:

1 Downward adjustment to any height obtained simply by pushing reversing lever up—then ratcheting exactly as done in raising.

2 Greatly increased capacity—15 tons—without increase in weight.

3 Easier operation—both in raising and tripping.

This jack has made a big hit wherever used; railway men cannot say too much in its favor. Don't fail to try it yourself; once you do, we are sure you will never be satisfied with anything else.

Write us now for free test and full particulars

THE DUFF MANUFACTURING COMPANY

Established 1883—Pittsburgh, Pa.

New York Chicago St. Louis Houston San Francisco Atlanta

Ask for FREE Demonstration without obligation on your part.

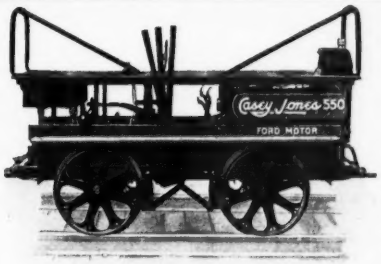
Casey Jones

REG. U.S. PAT. OFF.

For Every Railway Service

MAXIMUM VALUE

Lowest Standardized Prices **Motor Cars**



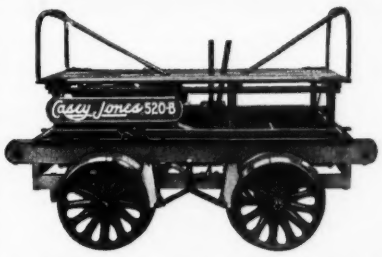
For Heavy Duty Service

Designed for heavy duty, this car is capable of giving better service for bridge crews, extra gangs and all heavy duty purposes. Motor service and parts available at every Ford service station.

$450.00 F.O.B. Eau Claire

STANDARD Ford Motor

Casey Jones 550 Heavy Duty Motor Car

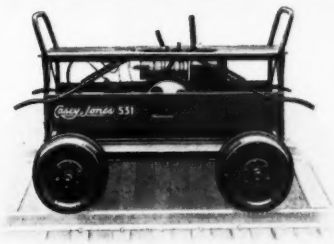


For All Section Gangs

Equipped with a 6 h. p. ball bearing free running engine, this car is capable of handling all section gangs. The most efficient and economical section motor car—lowest first cost—lowest cost of operation and repairs.

$199.00 F.O.B. Eau Claire

Casey Jones 520 B Standard Section Motor Car



For Inspection Service

Sturdy all steel frame construction—equipped with 4 h. p. ball bearing engine—free running—capacity four men and tools—spring suspended seat—the most powerful inspection car on the market—built for safety first.

$185.00 F.O.B. Eau Claire

Casey Jones 531 Safety First Inspection Car

Casey Jones cars must make good on the job. Designed for simplicity and ease of operation, all Casey Jones cars are of the center load, free running type and water cooled. When better motor cars are built Casey Jones will build them.

Write for complete specifications

SPECIFY Casey Jones
An investment in permanent satisfaction

NORTHWESTERN MOTOR COMPANY, Eau Claire, Wis., U. S. A.

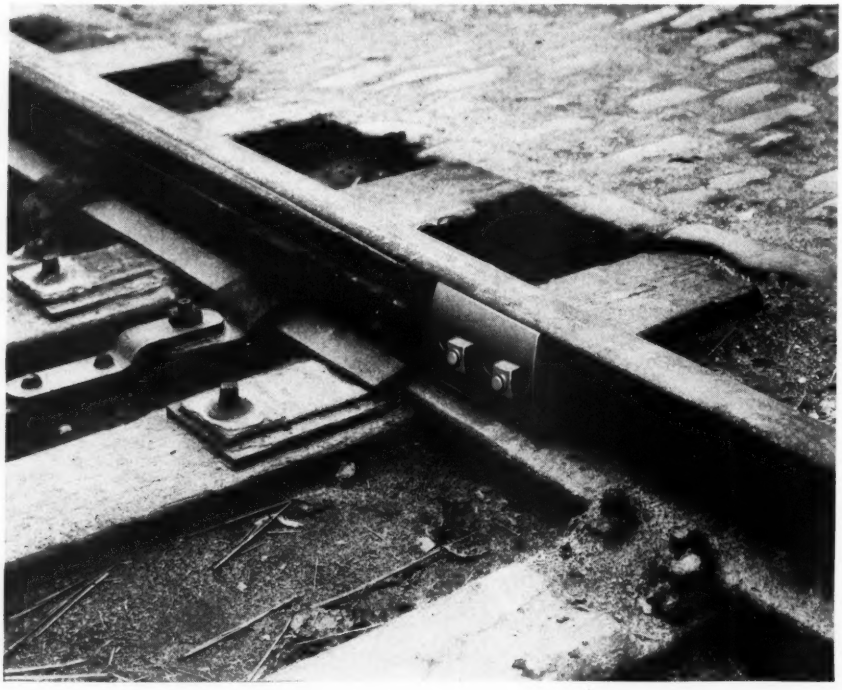
The Reversible "Mack" Switch Point Protector

THIS IS IT!

A NEW and distinct maintenance economy is made not only possible, but entirely practical, in the Reversible "Mack" Switch Point Protector. Mechanically, it is simplicity itself. As shown in the illustration, the "Mack" as now made, gives double the service by means of the simple operation of inverting it after one edge shows sufficient wear to make a new protector advisable.

In other words, the lower edge becomes the top edge and the service life of the protector extended to double the wear without additional cost.

Positively the most economical way to protect the switch point—and add years to its life.



An Economic and Safety Device

LET the Mack Switch Point Protector absorb the wear and increase the life of your switch points.

Mack Switch Point Protectors are simple, inexpensive, and positive in action. For switch points to last ten times longer with this protection is not uncommon in actual service tests.

Installation can be made easily at small cost—replacements are made in a few minutes by one man—their efficiency is not impaired by weather conditions.

"Mack" Switch Protectors are made of manganese steel, for any size rail.

Send us a description of rail used, and we will furnish you a few protectors for test

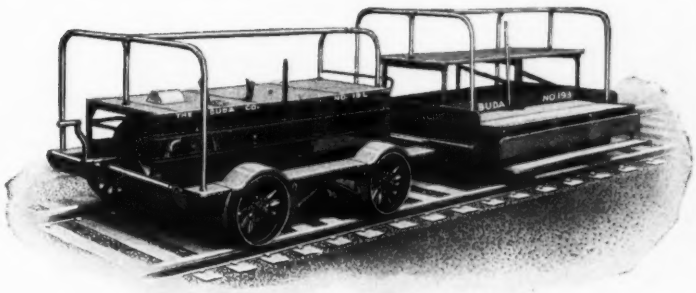
J. R. FLEMING & SONS, INC.

SCRANTON, PA.

Patented in U. S. and Foreign Countries

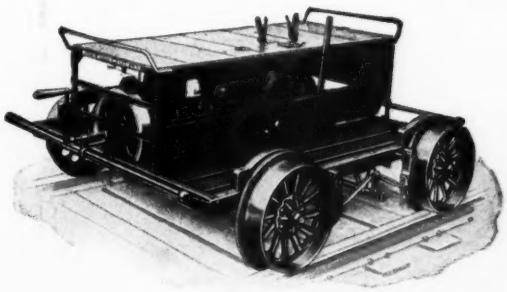
BUDA
ESTABLISHED
1881

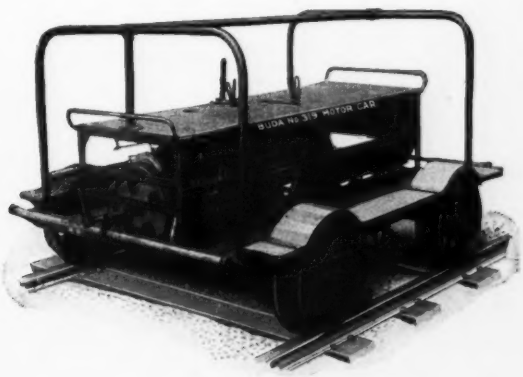
Buda Friction Driven Railway Motor Cars, based on performance over a period of years, combine lowest maintenance with economical operation together with correct design and a high standard of quality.



You purchase Buda Friction Driven Railway Motor Cars with entire confidence in a product borne of sound engineering and fully sustained by its record of successful performance.

No. 19-L Heavy-Duty Motor Car with Buda Trailer
Capacity, Motor Car.....12 or more men
Capacity, Trailer.....25 men





The "Dependable Nineteen" Series

Free Running - Friction Driven - Five Speeds Forward and Reverse

Ample Power For Trailing Load

Reliable motor cars under varying conditions of load, grade, climate and altitude for the safe handling of railway forces at speed consistent with "Safety First" requirements.

Start Under Their Own Power

Catalog on Request

THE BUDA COMPANY

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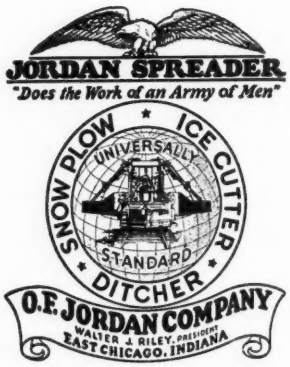
LONDON

JORDAN SPREADER

The Composite Spreader-Ditcher, which is the Jordan Spreader with the composite Spreader-Ditcher Attachment, performs all the functions of the Spreader (moves earth, spreads bulky materials, plows snow) and in addition will shape ballast and subgrade, form new ditches or clean old ones, and trim the banks of cuts to a uniform slope.



An all-year Machine. In use on North America's leading railroads.

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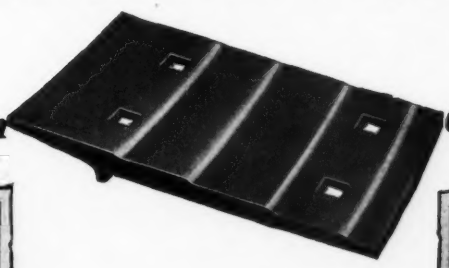
Under the same traffic conditions

LUNDIE TIE PLATE

Gives this greater tie protection

Lundie protection



Common tie plating

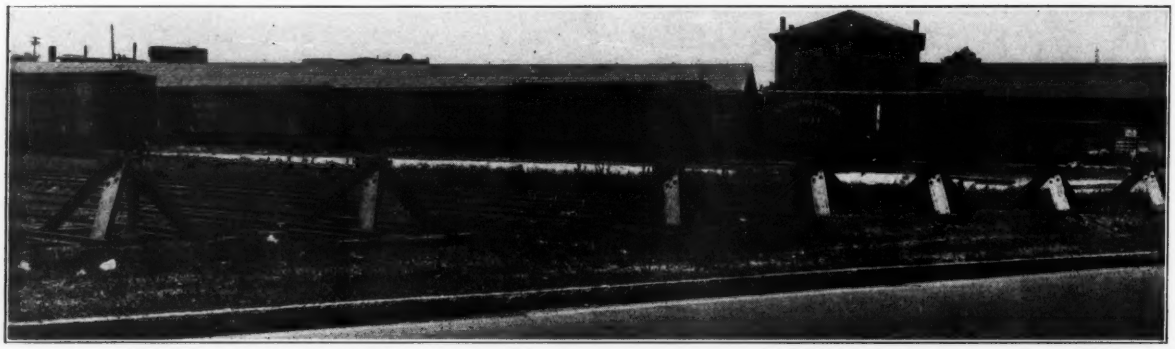
FIVE YEARS of identical service on a heavy traffic eastern road show the actual saving in costly ties through Lundie Tie Plate protection.

One tie nearly worn out.—The Lundie protected tie, good for many more years of service.

Such remarkable saving is due solely to the design of the Lundie Tie Plate, which compresses the tie, without cutting a single fibre.

The Lundie Engineering Company
920 Broadway, New York
166 West Jackson Boulevard, Chicago

LUNDIE DUPLEX RAIL ANCHOR



Bumping Posts That Stop Excessive Charges As Well As Uncontrolled Cars

The Durable Bumping Post has ample strength to stop cars. Obviously that is the first requirement in a good post.

But it also has other qualifications that make it the logical choice.

First: It occupies minimum track space. That saves excessive charges for construction work in congested districts.

Second: It is all above ground. That stops excessive charges for digging up hard or frozen ground.

Third: It has few parts, simply combined. That cuts the charges for both installation and maintenance.

Standardize on the Durable and stop excessive bumping post charges.

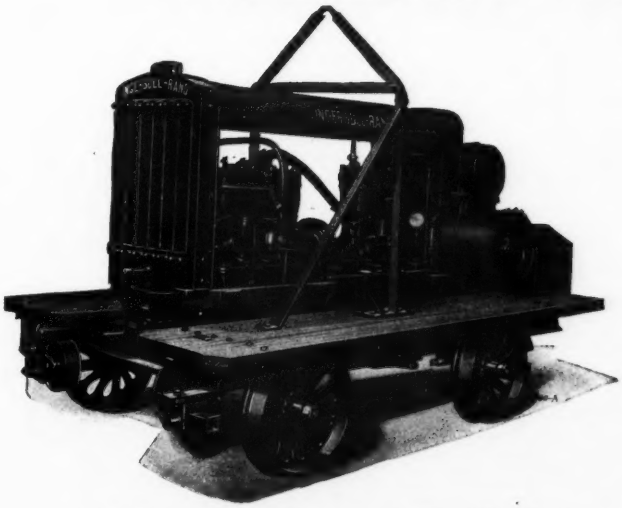
MECHANICAL MANUFACTURING COMPANY

Also manufacturers of the Ellis Bumping Post

Pershing Road and Loomis Street **Chicago, Illinois**

SEE OUR EXHIBIT IN SPACE No. 49 AT THE ROADMASTERS' CONVENTION, KANSAS CITY, SEPTEMBER 22 TO 24.

Pneumatic Tie Tamping



A 4-Tool Tie Tamper Compressor. Two other sizes to operate eight or twelve tampers can be furnished.

The easiest and most economical way to make good track

Ingersoll-Rand Pneumatic Tie Tampers tamp ties at less than half the cost of hand methods. It has been definitely proved that four men with pneumatic tampers will tamp more track per day and do a better job than 12 to 16 men using hand picks and bars. With the untiring power of compressed air, a firm and solid bedding is secured which other tamping cannot equal.

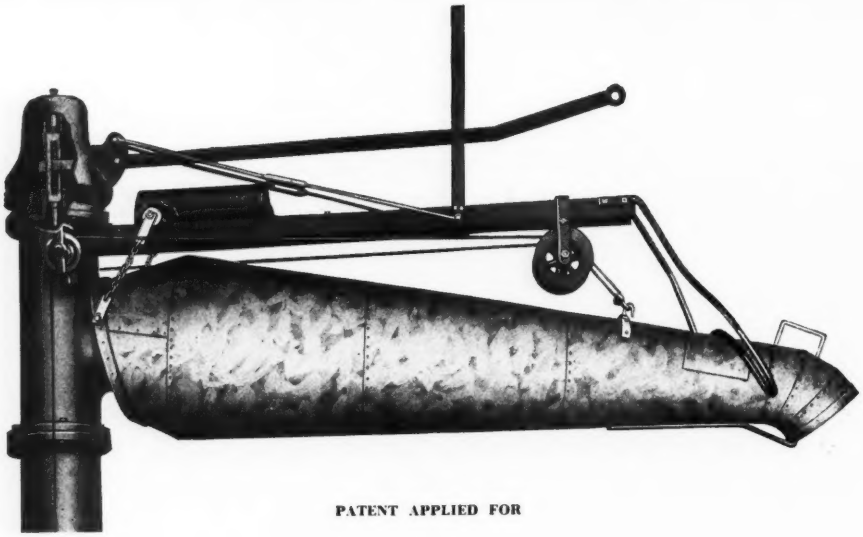
Ask for actual cost record of operation of pneumatic tie tamping outfits

INGERSOLL-RAND COMPANY—11 BROADWAY, NEW YORK CITY

Offices in principal cities the world over

FOR CANADA REFER—CANADIAN INGERSOLL-RAND CO., LIMITED, 260 ST. JAMES STREET, MONTREAL, QUEBEC

Ingersoll-Rand



PATENT APPLIED FOR

New Water Delivery Conditions

are met with the

UNIVERSAL

A New POAGE Telescopic Spout

Among the many new conditions constantly confronting railroads is that of adapting water columns now in use to the constant changing of equipment.

Tenders are now in use with the manhole 12 feet over rail. In addition to this, many have guard rails and other obstructions that increase the height to 15 feet.

The great problem is to obtain a spout that will accommodate these tenders and at the same time deliver water to a tender with a manhole but 8 feet over rail.

The POAGE *Universal* Telescopic Spout will do this without the least waste of water

The extraordinary range of the POAGE UNIVERSAL Spout does not exist in the Fenner or any other telescopic spout.

It will deliver water to the highest tender and also the lowest.

It can be applied to any POAGE Water Column now in use.

Send us your requirements and we will tell you how the POAGE UNIVERSAL Spout will meet them.

THE AMERICAN VALVE & METER CO., Cincinnati, O.

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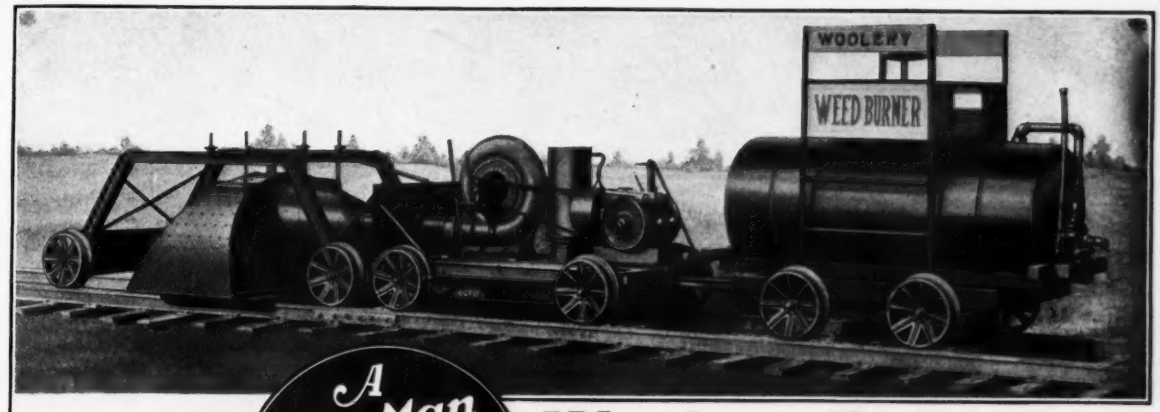


A Two-Man Outfit of Guaranteed Efficiency
Average cost on first heavy burning less than
$3.00 per mile

Note the clean, wide burned area that the Woolery leaves behind. In some places the weeds and quack grass had attained a height of 27 inches.

Woolery Railway Weed Burner

(Patent Applied For)

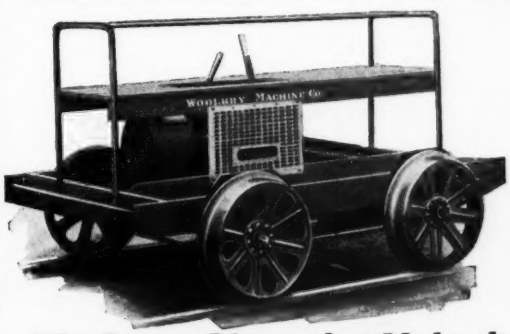
A self-propelled, three-unit outfit operated by two men. Speed from 1 to 5 miles per hour for burning, and up to 20 miles an hour for traveling. Compared with large and cumbersome machines, the Woolery is light—quick—nimble. Being easy to handle and quick to fire it gets around and can be used in places and on short burnings where other machines would be impractical. It may be removed from track at highway crossings. Total length of outfit, about 34 feet.

High Lights on the Woolery Weed Burner:

A Three-Unit outfit operated by TWO men.
Burns Gas Oil, Distillate Oil or Kerosene, and fire starts instantly.
ONE large Oil Burner—never whips out by tall weeds.
Burns a strip 11 feet wide.
Average burning rate, 2 miles per hour.
Fire may be shut off when crossing bridges. No drip of oil.
Fire relights automatically when fuel is turned on.
Outfit carries supplies for a full day's operation.
Any speed from 1 to 20 miles per hour on its own power.
Easily loaded on a flat car for long moves.
Operation is simple and easily learned.
All steel construction—safe and dependable.
Low fuel consumption, thoro work, and no train crew.
A clean, dry, withering hot fire—leaves no oil on the rails.
Four-Wheel Drive and Four-Wheel Brake—ample traction and safety.
Chrome Nickel Steel Ball-Bearing Axles—Strong and Easy-Running.
Entire workings of machine controlled from Driver's seat.
It may readily be removed from track at a highway crossing.

Always Ready for a Demonstration on Any Railroad

Read this ☞ **Meet us at the Track Supply Association Exposition at Booth 30, Convention Hall, Kansas City, Mo., Sept. 22, 23 and 24, 1925**



The Woolery (Model M) Railway Motor Car

Light in Weight—100 Per Cent Overload

A car for every road—for any Climate—for all kinds of Service. Power to meet requirements. It can be used as Section Car, Extra Gang Car or Small Work Train. Normal Capacity, 10 passengers. Instantly removable side seats which increases the seating capacity to 20 men, can be supplied. Chrome Nickel Steel Ball-Bearing Axles. Steel Hand Railing and Lift Handles, Steel Engine and Wheel Guards. Steel Truss Frame contributes enormous strength.

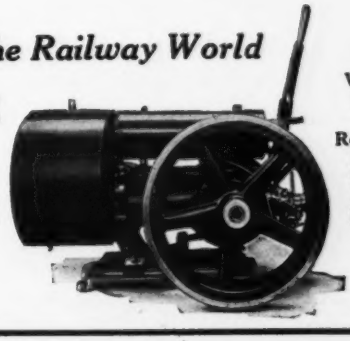
The Power Plants that Make the "Woolery" the Marvel of the Railway World

The Woolery Model "C" Reversible Engine

A powerful, light weight ball-bearing engine with speed control of from 400 to 1200 revolutions per minute. Develops 9 horse power on the brake test. Designed to use gasoline, but works efficiently on a mixture of kerosene and gasoline.

The Woolery Model "TC" Twin Cylinder, Reversible Engine with Two-Speed Transmission

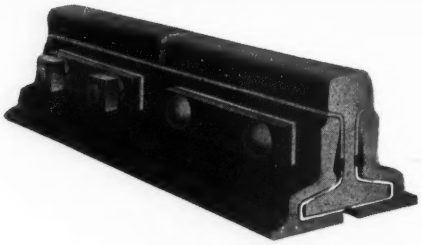
Ball-bearing, perfectly balanced, and smooth running. Develops 18 horse power on the brake test. Admirably adapted to the heavier class of section and construction work, and is powerful enough to save a work train many trips.



The Woolery Model "C" Reversible Engine 9 h. p. on the Brake Test

Write for Full Information and Detailed Description of Woolery Railway Motor Cars and Engines

WOOLERY MACHINE CO., Minneapolis, Minn.



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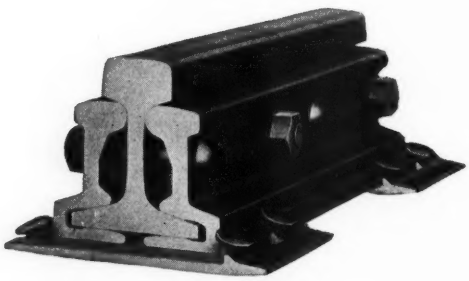
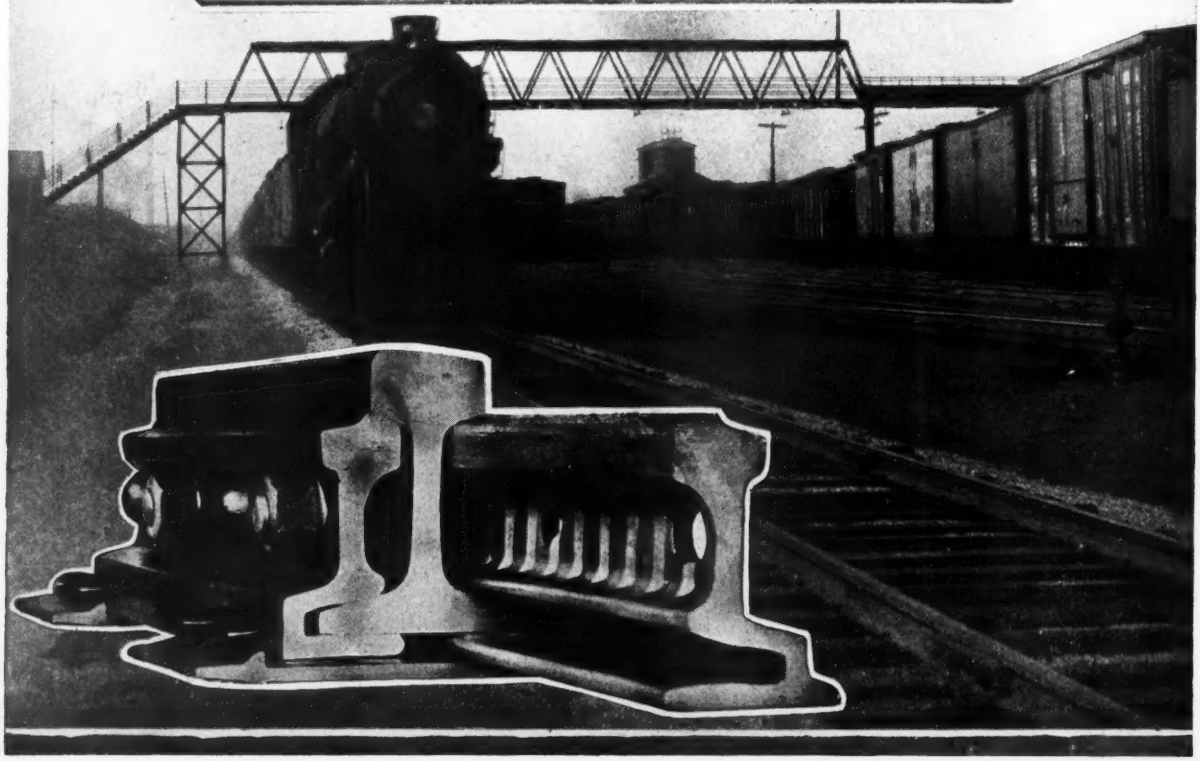
RAIL JOINTS

DURABILITY ~ SAFETY ~ ECONOMY



The Rail Joint Company

61 Broadway New York



Railway Engineering and Maintenance

Volume 21 October, 1925 Number 10

EFFECTIVE EQUIPMENT IS NECESSARY

THE RELINING and enlarging of tunnels are operations rather infrequently imposed on most railroads but on a few systems the mileage of tunnels is so great that work of this character is almost constantly in progress. This is notably the case on the Southern Pacific, which has a force of men engaged in this work from one year to another. In the case of the work on the Los Angeles & Salt Lake, described elsewhere in this issue, the project now under way will not be completed for some five or six years.

In cases where such tunneling work is in considerable volume, authority for the purchase of effective mechanical equipment is readily obtained. But even where the work is not so extensive, there is definite economy in the use of good tools and appliances. Efficient rock drills, a good concrete plant, high-grade air compressors and portable electric lighting outfits have almost come to be accepted as necessities for work of this kind. In such operations the interruptions due to train movement sometimes reduce the effective working time of the force to as little as three hours a day. Consequently, if any marked progress is to be made it is essential that every means be afforded to make the efforts of the crew as effective as possible.

KEEP WATER OFF HIGHWAY APPROACHES

IN ITS REPORT on the disastrous derailment near Hackettstown, N. J., in the early morning of June 16, in which more than 50 persons were killed, the Bureau of Safety of the Interstate Commerce Commission attributes the cause to the washing down of earth and gravel from the travelled part of the highway into the flangeways and over the rails. While in this particular instance no trouble of this character had been experienced for 25 years and the commission placed no blame on anyone, the fact that the accident occurred shows the necessity for constant attention at such points.

It emphasizes particularly the necessity of so grading the approaches of highway crossings that no water will be diverted from the highway into the ditches before reaching the track. In most cases this involves no difficulty because the approaches ascend to the tracks. Instances are not infrequent, however, where the reverse condition prevails and the road descends onto the tracks. Here special precautions are necessary to avoid the conditions which developed near Hackettstown, and measures should be taken by the insertion of a slight dip in the road or other means to lead the water off the road. While this problem is of long standing it has become more serious with the increasing use of the highways. The addition of much gravel or other loose surfacing materials may lead to the formation of ruts by a few days' heavy travel which will provide channels for the water, entirely contrary to those normally provided, and thus produce a condition necessitating constant attention.

WINTER CONCRETE WORK

IN AN ARTICLE, which appears on another page, A. M. Bouillon makes a strong case for the conduct of concrete work in winter. His arguments are backed up by numerous examples of important bridge work that has been carried out successfully under extremely low temperatures. Some readers may question whether his comparison of the obstacles of summer and winter work is a fair one. It may be claimed that the difficulties cited for summer work are not typical. For example, there is much bridge substructure work that does not impose serious possibilities of flood damage and there are many situations where transportation facilities are as good or better in summer than they are in winter. However, the question as to the relative economies of summer and winter work is one that can only be settled in accordance with calculations based on a study of local conditions. The main value of the article referred to is that it shows conclusively that large and important railway concrete work can be carried out successfully and economically in the face of extremely severe winter weather. In these days when much thought is being given to opportunities for obtaining a greater stability of labor, the possibility of winter construction is pertinent.

COST OF WEEDING IS BEING REDUCED

ONE OF THE most unproductive and yet most necessary maintenance of way tasks, is the removal of weeds from the tracks. They are universally present and are constantly struggling to gain a foothold in the ballast. As greater expenditures are made for ballast it becomes increasingly important that it be kept free from weeds and other deteriorating agencies so that it may perform the primary functions of supporting and draining the track unimpaired. The original and for many years the only method of removal was by hand. This was expensive. It also constituted a serious drain on the time of maintenance of way forces at seasons when they could not well be spared. To meet this condition other methods have been developed, first among which was the weed burner, followed by the use of chemicals and steam. Marked reductions in weeding costs have been obtained by these measures. But this development is continuing with every indication that still further reductions in cost will be effected in the very near future. The present status of these methods is well set forth in a report presented before the Roadmasters' Association and printed on a following page.

AN INDEX OF EFFICIENCY

THE motor car has come to be a standard unit of equipment for most maintenance and construction gangs. Through its use the men are relieved of much laborious pumping of hand cars. The amount invested in them is so large, however, that it is incumbent upon the foremen under whose supervision they are operated to see that they are properly maintained.

One of the most essential requirements is that the cars shall be kept clean. This is necessary for several reasons. It has been demonstrated conclusively that cars that are kept clean offer the least trouble, cost less for repairs and give the best service. Furthermore, if a man cleans his car thoroughly at least once each week, he will detect loose bolts or nuts and other troubles before they have time to do much damage. A further consideration is the fact that a considerable percentage of motor car accidents result from the gradual failure of parts over a considerable period of time and with frequent periodic inspections these failures are detected in their early stages and eliminated. Some roads insist that foremen inspect their cars at stated intervals, but ordinarily there is no assurance that these instructions are followed. Clean cars provide such assurance.

A further and important advantage of the enforcement of a rule that motor cars must be kept clean is its influence on the general orderliness of the members of the gang and on the work which they do. If a man keeps his motor car clean, it will be found that his tool house is orderly and his work systematically done, while if he allows his car to become greasy and dirty his work will usually be found to be correspondingly slovenly.

The degree of cleanliness of a motor car is a more accurate index of the habits of a foreman than is commonly realized. He owes it to himself, therefore, to inquire whether this index is all that he desires it to be in the eyes of his superiors.

ASSOCIATIONS

The thing that most interests any normal and intelligent man is his work. It requires more of his time and attention than any other interests he has. It is by perfection in it that he hopes to increase his ability to buy those things that contribute to the wellbeing of himself and his family.

Out of this interest and desire for improvement have come organizations such as the American Railway Engineering Association and the Roadmasters' Association. Their value is too well recognized to require argument. Their appeal has, however, been confined largely to supervisory officers of roadmaster rank and higher.

Of late organizations of foremen have also come into being on several roads which provide a medium through which these men can also discuss their problems with their fellows in an effort to improve their methods by the exchange of ideas. These associations, properly organized and directed, can do much to stimulate the efficiency of their members, to raise their morale and to increase their interest in their work and in the road from which they derive their livelihood.

ROADMASTERS' ASSOCIATION IS A CONSTRUCTIVE AGENCY

ONE OF THE outstanding developments in railway association work in recent years has been in the improvement in the character of work done by the Roadmasters' Association. Its coordinate association, the American Railway Bridge and Building Association, has long held an enviable record for constructive work but for a time the roadmasters' organization fell short of its opportunities with the result that interest lagged, convention attendance declined, and the work suffered.

Starting about 15 years ago, however, this organization began to take on new life and each year since that time has brought it to a new high plane. As a result, this association is now entitled to, and commands the respect and support of railway officers of all ranks. This is evidenced by this year's program which, in addition to five well-prepared committee reports, includes addresses by W. B. Storey, president, Atchison, Topeka & Santa Fe; L. W. Baldwin, president, Missouri Pacific; Colonel F. W. Green, vice-president, St. Louis-Southwestern; C. E. Johnston, vice-president and general manager, Kansas City Southern, Colonel F. G. Jonah, chief engineer, St. Louis-San Francisco, and A. N. Reece, chief engineer, Kansas City Southern. As a result of the presentation of programs of this character, more men are attending the conventions each year and participate in the discussions, while the reports are becoming increasingly valuable in their practical treatment of live problems.

A relatively recent development in this association which is of particular significance, is the change in the attitude of the so-called "practical" men who long constituted the bulk of the membership in this organization toward men who have had the benefit of technical training. There was a time when the latter were not welcome and their appearance was considered more or less of an intrusion. Of late, however, this feeling has entirely disappeared and men of both schools of training discuss their common problems to their mutual benefit.

An important feature of the roadmasters' conventions and one which has added much to the value of its meetings and has done much to stimulate attendance, has been the exhibit of materials and equipment. The character of the exhibit equals that of the National Railway Appliances Association in March in that the equipment itself, rather than the models, is shown. More than 50 firms bring products designed for track use to the convention, affording attendants an opportunity to see and study the newer developments in the tools and materials which American inventive genius has developed for their use. Track work is rapidly becoming more scientific and complicated in character and exhibits such as these do much to inform practical railway men of the newer developments.

THE GROWTH OF TIMBER PRESERVATION

STATISTICS on timber treatment presented elsewhere in this issue point to the marked progress which has been made in the application of preservative processes to ties and timbers. They do not, however, convey an adequate picture of the remarkable growth of this phase of timber conservation over a considerable period of years. While wood preservation was practiced to a limited extent as early as 1860 it was largely of an experimental nature until almost the

beginning of the present century. The progress that has been made since that time can be exemplified by a few figures, which are remarkable, to say the least.

Thus, according to census reports, the number of ties treated in the United States in 1900 was only 2,800,000, or less than four per cent of all ties used. In 1924, according to statistics presented elsewhere in this issue, the ties treated numbered 62,632,710, or about 50 per cent of all ties used. Unfortunately, authentic figures on the volume of other timbers subjected to treatment are not available for any year earlier than 1909, but even in the 15 years since that time the growth in wood preservation has been sufficient to afford some remarkable contrasts. For example, the volume of construction timbers, which includes the timbers used by the railroads in wooden bridges and trestles which was subjected to treatment in 1909, was 5,286,120 cu. ft., as compared with 24,291,231 cu. ft. in 1924. Wooden piles treated in 1909 totaled 4,421,226 cu. ft., as compared with 11,675,756 cu. ft. in 1924. The total volume of all wood treated in 1909 aggregated 75,946,419 cu. ft., compared with 268,583,435 cu. ft. in 1924. Thus, in only 15 years the use of treated timber has increased fourfold as regards bridge and trestle material, the use of treated piles has doubled and the treatment of wood used for all purposes has increased 3½ times.

This increase in the use of treated wood has had its effect in the education of the user in the advantages and economies of preservation. It is not so many years since the average trackman was wont to express his preference for untreated white oak ties and earnestly hope that he would continue to receive enough of them to make it unnecessary for him to "bother" with any treated wood. It is not so long since the purchase of all-heart timber was considered the first requisite in obtaining longevity in a wooden bridge. But these days have passed. The economic necessity for treatment is now generally appreciated and practically all maintenance of way officers are doing their part to promote the use of treated timber and to educate their foremen in the significance of timber treatment and in the precautions which must be taken in the proper handling of such materials.

ARE YOUR HIGHWAY CROSSINGS BEING PROPELY MAINTAINED?

IN SPITE of the attention which has been focused on the grade crossing of late, and the emphasis which has been placed on the necessity for care on the part of drivers of highway vehicles, the number of accidents at these crossings continues to increase. This is in part a reflection of the steadily increasing number of vehicles using the highways and in part of the greater use made of these vehicles. It is also an indication that work yet remains to be done to make these crossings as safe as possible.

While the only complete solution of the problem is the separation of grades this is generally recognized as impracticable. The highway crossing is here to stay for it is to be expected that new roads and streets will continue to be opened more rapidly than existing crossings are eliminated by abandonment of crossings or the separation of grades. The problem, then, is to reduce the hazard at these crossings as much as possible. This is a responsibility of maintenance of way forces.

In the fulfillment of this responsibility it is incumbent on all concerned with the maintenance of these crossings to know that all precautions have been taken that may reasonably be expected. They should satisfy themselves that the roadway across the track is so maintained as not only to offer a smooth riding surface but also to require so little of the driver's attention that he will be free to give a careful lookout for trains. Measures should also be taken to see that the approaches to the crossing are on a grade sufficiently flat to avoid danger of stalling the motor and that they are wide enough to permit cars to pass without danger. Of particular importance is the provision of an unobstructed view of the track for a sufficient distance each way from the crossing to permit a driver to see whether the way is clear in time to stop, if necessary, before reaching the crossing. It is not enough to know that the brush was cut last year, for it may have grown sufficiently since that time to again obstruct the view and create a hazard.

Until these and similar precautions have been taken, no road and no maintenance officers can free themselves from at least partial responsibility for accidents at such crossings. In general, the improvements necessary are so minor that they can be made by the local officers without special authority. For this reason every division engineer, every roadmaster, and every foreman should make a critical study of the crossings under his jurisdiction at frequent intervals to insure that they are in proper condition and will be so maintained.

KEEPING DOWN THE DUST

ONE of the problems confronting the railways during the summer season is that of keeping down dust. This problem is often particularly aggravating at highway crossings and in the vicinity of stations although it may extend for miles owing to the use of ballast containing a large proportion of sand and other fine particles. In some instances in the semi-arid and arid areas, it is the result of sand blowing in from beyond the right-of-way fences.

Whatever its source may be, it is highly objectionable, particularly on those roads which have a considerable amount of high class passenger traffic. Few conditions are more objectionable to patrons than clouds of dust, which not only render expeditures for observation cars useless but also filter through the other cars to the discomfort of passengers. A few miles of dusty track will overcome the favorable impression from hundreds of miles of smooth track. Furthermore dust is detrimental to equipment, by reason of its ability to get into bearings and cause trouble.

The elimination of dust has not yet received the attention which it warrants from the railways of this country. A few roads have sprayed oil over their tracks as a means of overcoming this nuisance, but this practice is far from general; in fact, it has been abandoned by several roads as unsatisfactory for the reason that such dust as is created by trains is more objectionable because it is oil-coated. One road has applied sprinklers to certain of its passenger locomotives to lay the dust while the train is passing. The most satisfactory remedy for general adoption, however, is the use of stone or a good grade of washed gravel ballast. Some roads consider this characteristic of ballast carefully when selecting material for this use and will incur considerable additional expense to secure a ballast that is relatively free from dust. Other roads may well afford to consider the same expedient. It also behooves roadmasters to give consideration to local points of dust origin to see if they cannot be eliminated by less expensive measures.

Letters to the Editor

THE STRING LINING OF CURVES

East Aurora, N. Y.

To the Editor:

The letter of J. R. Watt on string lining curves in the September issue of *Railway Engineering and Maintenance* suggests some interesting points. First of all the method described by Mr. Watt appeared in my book, "Practical Railway Maintenance," which was reviewed in *Railway Engineering and Maintenance* soon after its publication in 1923.

Whatever method of straightening is used, there is no necessity for writing down the ordinates in inches. It is a simple matter to change the inch marks on a ruler so that it will read eighths directly. This saves almost as much time for an experienced computer as is required to actually figure the throws.

The result obtained in column E of Mr. Watt's example is a curve that would have to be relined again. It is a question whether it would not be better to use a transit at the start and obtain a perfect curve with flatter run-offs than to follow the method suggested.

String lining is a quick and simple method for improving the line of a curve. In order to demonstrate this fact, I have used another method taken from my book and which also appears in that of W. F. Rench. The result as shown below was obtained in seven minutes. While it is also not a mathematically perfect curve, observation convinces me that it will ride at least as smoothly as Mr. Watt's curve. Besides the latter requires throws at every station, running as high as 2¾ in., not to mention the second lining required, whereas in my solution nine stations require no lining, one station is thrown 1¾ in., one 1¼ in. and the remainder a maximum of ½ in. This point is very important for, assuming that the track has been well put up and the ties thoroughly tamped, the smaller the disturbance to the line the more permanent will be the work.

Sta.	Ord. In 1/8"	Throw	Net Throw	Final Ord.	Super elev.	Remarks
3	2			2	1"	
4	5	7		7	1½"	
5	18	-4 14 15 16	-4	16	2"	
6	29	31-2 29 28	-4	28	2½"	
7	36	37 -2 36	-2	36	3"	Note:- The figures under "superelevation" are only used to show method.
8	43	44		44	3½"	
9	51	52		52		
10	54	-2 52 51	-2	51		
11	46	47+2 49 50	+2	50		
12	55	54-2 52	-2	52		
13	51	51 52		51		
14	43	+2 45 47 50	+2	50	4"	
15	60	59-8 51 50	-10	50		
16	45	49 -2 49 50	-2	50		
17	54	54 53-3 51	-4	51		
18	46	47 48-50		50		
19	49	54 -4 52	-4	52		
20	64	-10 54 52 53	-14	53		
21	36	41 43 -2 42	-2	42	3½"	
22	24	24 23	-2	23	3"	
23	12	13		13	2½"	
24	6			6	2"	
25	2			2	1½"	

Table of Measurements and Throws

I cannot agree with Mr. Watt as to the difficulty of the method I have used. It is hard to conceive of an engineer who would have any trouble with either method and I believe the same is true of roadmasters and supervisors. In my own limited experience I have been able to teach either method to about 30 per cent of my section foremen.

The flexibility of either method is also important for at such points as bridges or heavy crossings throwing track may be out of the question. With Mr. Watt's method this is possible but difficult, whereas with the other method it is usually a simple matter to improve the line by throwing at either end of such fixed points.

The method illustrated by Mr. Watt has certain advantages, where an engineer with a transit is not available, and a curve has lost all semblance of line, for it offers a quick means of getting it back to fair line. It would be a waste of time, however, to set stakes for this first solution as a second lining would be necessary.

The subject of string lining should not be dismissed without reference to superelevation and I suggest that a column be left for this item so that the liner can note what the elevation should be at points on the run-off and later mark it on the track for the guidance of the foreman.

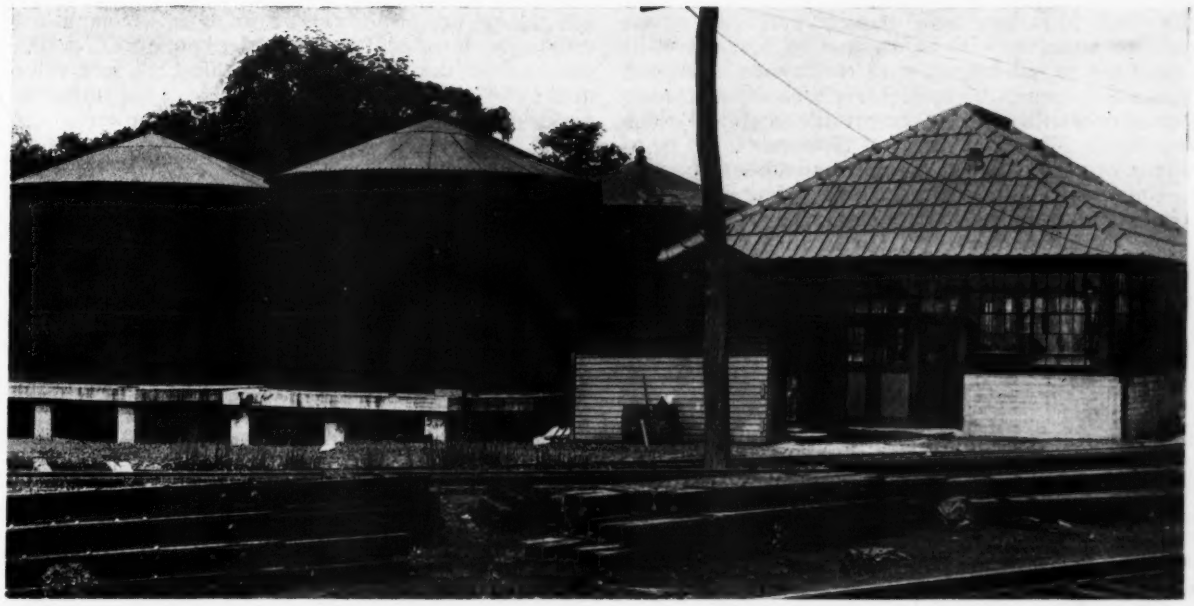
CHARLES WEISS,
Assistant Supervisor, Pennsylvania.

NEW BOOKS

Proceedings of the American Wood Preservers' Association for 1925. 384 pages. Illustrated. 6 in. by 9 in. Bound in cloth. Published by the association, E. J. Stocking, secretary, 111 W. Washington street, Chicago.

This volume, comprising the report of the convention held in Chicago on February 3, 4 and 5, 1925, corresponds in form and substance to previous issues of the proceedings of this society. As in previous years the subject matter falls under several general heads, reports of scientific studies of the chemistry and physics of timber preservation, discussions of practical problems of plant operation and the handling of material in yards, and the compilation and analysis of service test records of treated timber applied to such uses as ties, poles, posts, piles, etc. One of the newer developments covered in this volume is a report on the discovery of a method for impregnating timber with zinc chloride and petroleum by an emulsion process. Another subject presented which is of definite interest to maintenance of way men is a study of the economics of the use of treated and untreated timber. Another paper discusses the advisability of treating ties subject to incipient rot. Supplementing the report of the convention is a statistical report on the use of treated timber and the consumption of wood preservatives, prepared by R. K. Helphenstine, Jr., of the United States Forest Service.

CANADIAN SHIPPERS PROTEST — A strong protest against duplication of service by the two principal Canadian railways is made by the Ontario Fruit Growers' Association and the Niagara Paninsula Fruit Growers' Association in a joint memorandum to the Dominion Railway Board. "It is our long-established opinion that the railway services of Canada are extravagant, and out of proportion to our population and present circumstances, and that the need of agriculture and other basic industries is for self-supporting transportation of their products, rather than for burdensome extravagances, such as duplication of expenses resulting from the maintenance and operation of parallel lines of separate terminal facilities at common points, luxurious and duplicated passenger services and railway wages so apparently an inflexible factor in railway operation costs. The expense of intense traffic solicitation is a burden that may well be lifted from the costs of transporting our products." Evidently competition is no longer an advantage.



Pump House, Lime House and Settling Tanks

New Lackawanna Water Station Shows Low Operating Cost

New Fuel Oil Engines Reduce Expense of Pumping to Only 51 Per Cent of That Incurred With Old Equipment

By H. W. Machemer
Assistant Engineer, Delaware, Lackawanna & Western, Buffalo, N. Y.

THE COST OF delivering water into storage tanks has been cut practically in half by the installation of new equipment at the pumping station of the Delaware, Lackawana & Western at Groveland, N. Y. This has resulted from the installation of fuel oil engines in a new plant in place of steam equipment in an old combined power house and pumping station. Following the installation of this equipment the expense per thousand gallons pumped to the storage tanks was only 51 per cent of that in 1923, the last year the old plant was in service.

Groveland is located about 70 miles east of Buffalo, N. Y., at the foot of a 13-mile grade known as the Dansville hill. All eastbound freight trains require pusher service and all freight trains in both directions take water, the daily consumption ranging from 300,000 gal. to 500,000 gal. An engine house, coaling plant and power house are maintained at this point.

Old Equipment In Deteriorated Condition

The old plant was a brick structure located at the east end of the yard about 1100 ft. from the reservoir and Canasaraga Creek, the source of the water supply. The source of power in the old plant consisted of two old 150 hp. locomotive-type boilers, injector fed, with the exhaust from equipment going to the atmosphere. The pumping equipment consisted of two 12-in. by 8-in. by 12-in. and one 14-in. by 8-in. by 12-in. reciprocating pumps. The treating apparatus included lime and soda ash tanks, one small solution pump, one locomotive-type air pump and two standard Lackawanna filter tanks. A 50 kw. generator driven by a 30 hp. steam engine was also located in the pumping room which was used for lighting and power purposes. All equipment was badly worn and in constant need of repairs.

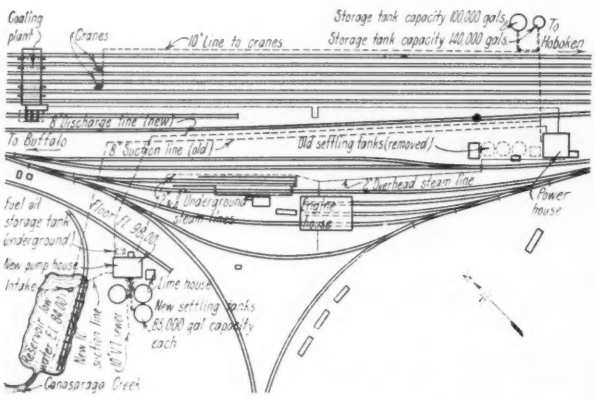
During the busy season, the day shift was not able to allow the water to settle sufficiently after treatment before pumping to the storage tanks. Water is stored in two tanks, one of 140,000 and one of 100,000 gal. capacity. These are located across the main tracks from the power house, the top of the higher tank being 67 ft. above the top of rail.

At the time of renewal of these facilities it was decided to separate the water service from the power service, necessitating a new water service or pumping station. Upon its completion and the removal of the old equipment from the power house, a new 50 hp. steam engine was installed to drive the 50 kw. generator and a 30 kw. generator installed for the 30 hp. steam engine in the old pump room, together with a Cochrane feed water heater and feed water pumps. The 14-in. by 8-in. by 12-in. pump was also left in the pump room to supply raw water to the engine house for washout purposes. The additional electrical equipment was not installed solely for additional requirements at the new pumping station, this being only 8½ kw. at peak load, but to maintain the required service at the coaling plant during periods of maximum demand.

The new building is located 90 ft. from the reser-

voir. It is 51 ft. long by 34 ft. wide, and is a concrete and steel structure with hip roof. Concrete side walls were built to sill height, with continuous steel sash from sill to cornice. The building presents a pleasing appearance with its red cement tile roof and ridge ventilator. The inside vertical clearance is 16 ft. as required by the engines. The continuous sash permits maximum venilation so that the building is not uncomfortable from the heat of the exhaust pots of the engines in extreme weather. The heating requirements for winter were designed for 55 deg. F., and are met by sixteen 11-section radiators.

A 12-in. suction line with a 12-in. foot valve was laid from the reservoir on a straight grade of about 11 per cent. The intake in the reservoir is a 6-ft. by 5-ft.



The Layout at the Station, Showing Location of New and Old Facilities

piling and timber framework, with removable ¼-in. by No. 14 gage screens on three sides. The 12-in. suction line is 90 ft. long as compared with the old 8-in. line 1100 ft. long and made possible the installation of more economical pumping units. The center of the impeller of the pumps is such that the total suction lift is 18.33 ft.

Three 6-in. suction and 6-in. discharge single stage centrifugal pumps were installed. They were designed for a capacity of 750 gal. per min., and to work against an average head of 100 ft., including pipe friction and a suction lift of 17 to 19 ft. They are driven at a belt speed of 4,000 ft. per min. or 1,200 r.p.m. All three pumps are exactly alike and interchangeable in all parts except that one is fitted for a speed of 800 r.p.m. This pump is used for a total head of 35 ft., including 17.33 ft. total suction lift, and is set in a recess 12 in. deep. It is used only to pump water from the reservoir to the settling tanks.

The three pumps are set in a straight line, with the suction piping in a pit alongside and the discharge piping in a pit on the other side, both pits being deep enough to allow entrance and exit of piping below the frost line outside without additional fittings. The pump at the east end is used only to pump water from the settling tanks to the storage tanks. The middle pump is so connected by piping and valves that it can be used for either suction to settling tanks or discharge to storage tanks. The fact that both suction and discharge lines in the pits are connected in straight lines from the west end to the east end facilitates the use of a minimum number of valves and fittings. Provision has also been made in the size of the pits to allow the two higher speed pumps to be connected in series by installing additional fittings if increased pressure is desired for fire protection. Priming is accomplished ordinarily by maintaining water pressure on the pumps from the service main, as there is a foot valve at the end of the suction line. An ejector operated by air is installed as an emergency priming unit.

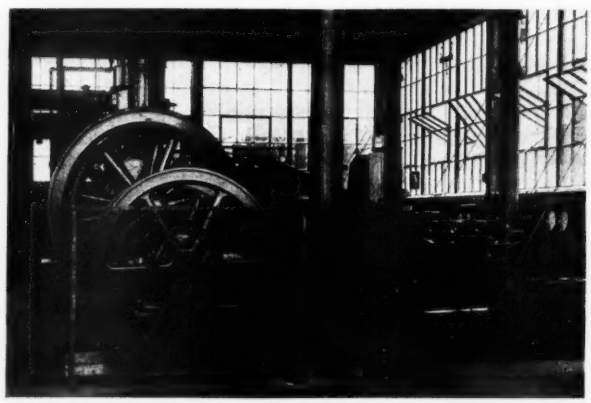
Well Designed Piping Layout

All water piping is 8 in. standard weight, black steel pipe inside the building and leading to the settling tanks. Flanged fittings were used in the building. The 8-in. discharge line from the building to the storage tanks is standard weight cast iron H. & S. pipe. All pumps are belt-connected to the engines, a 9-in. by 9/32-in. double leather belt being used in all cases. Adjacent to the pumps are Lenix overhead drive idler systems, counterweighted by overhead cables and weights along the wall. This system reduces the distance from center of engines to pumps to 10 ft., saving about 5 ft. in the width of the building. This saving would have been greater if it had not been for the necessary pipe pit between the pumps and engines.

The driving engines for the two higher speed pumps are 50 hp. Type Y Fairbanks-Morse vertical, two cycle, single cylinder, fuel oil engines. For the lower speed pump a 15 hp. horizontal, fuel oil engine of the same make and type is used. Cooling water is supplied from the service mains. Fuel oil is piped in trenches under the floor from an outside pit adjacent to the building in which is stored an auxiliary fuel oil tank for each engine. About eight feet from this pit, a 6075-gal. capacity steel fuel oil storage tank is buried underground. This tank is filled by gravity from a car on the siding alongside and fuel oil is transferred to the auxiliary tanks by a rotary hand pump with a flexible steel hose.

The Treating Facilities

All water taken from Canasaraga Creek must be treated and the treatment at this point is of the intermittent type, utilizing lime and soda ash. Air agitation is used and the mixture is allowed to settle for



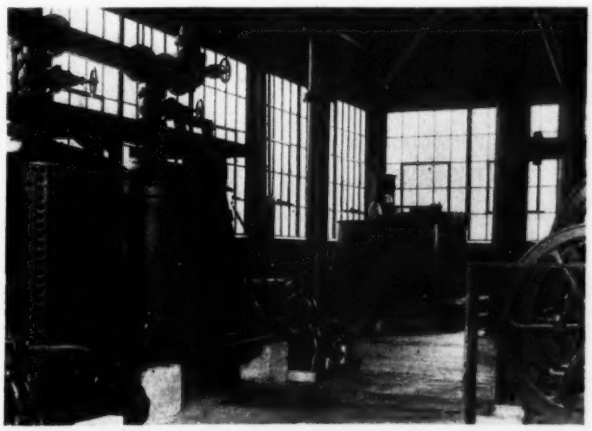
Fifteen Horsepower Engine and Centrifugal Pump Used as Suction Unit in Foreground, Spare 50 hp. Unit in Rear

four hours before being pumped to the storage tanks. The settling tanks are of steel, 30 ft. in diameter by 18 ft. high, with a conical roof, and were furnished and erected by the Chicago Bridge and Iron Works. They have a working capacity of 85,000 gal. each, and are supported by a 14-in. reinforced concrete slab resting on three piers, each 30 ft. long by 2 ft. wide, placed 10 ft. center to center. The 8-in. inlet pipe runs inside to the top of the tank so that the sediment at the bottom, which is cleaned out periodically through a trap

door at the bottom, is not disturbed by the entrance of water. The 8-in. outlet pipe consists of a galvanized iron swinging arm with a float at one end and attached to an 8-in. swing joint at the bottom of the tank, permitting the drawing of water from the top surface. An electrical annunciator system notifies the operator in the building when the tank has been pumped nearly empty so that there is no probability of running the centrifugal pumps when dry. The tanks are also equipped with the standard indicator.

The chemical tanks are of the Graver type and are located inside the building. The lime tank is 5 ft. in diameter and has a capacity of 500 gal. It is mechanically agitated by revolving blades driven by a belt connected to a 1 hp. motor. The soda ash tank is also 5 ft. in diameter with a capacity of 500 gal. steam for heating the solution and air for agitating it are supplied to this tank.

A 3½-in. by 4-in. Gould triplex plunger pump, connected to a 2 hp. motor, delivers the solution to the settling tanks. It has a capacity of 30 gal. per min.



Two of the Three Filter Tanks at Left and Triplex Pump, Soda Ash Tank and Lime Tank at Center in Rear

against a total head of 60 ft. Air is supplied to the settling tanks for aeration and agitation by a 7-in. by 6-in. Ingersoll-Rand air compressor driven by a belt-connected 7½ hp. motor. It has a capacity of 50 ft. of free air per min. at 50 lb. pressure and is also used for emergency air priming of pumps and fo. agitation of the soda ash mixture. After the treated water is pumped from the settling tanks it is run through three Lackawanna standard pressure filters 5 ft. in diameter and thence to the storage tanks. Washout of these filters is accomplished by reversal of flow through them with pressure from the service mains.

Work Started in 1923

The construction of this project was started in 1923. It was found necessary owing to the very poor bearing capacity of the soil in the vicinity of the creek to drive piling under all structures, including those of the lightest character. To construct the intake, it was necessary to dam the reservoir at its inlet and pump it down below the elevation of the flooring under the foot valve. Water service from the old power house was maintained during this construction.

At the beginning of operation the east 50 hp. unit was used for its regular work and the 15 hp. unit for its regular work for one week. The second week the spare unit took the place of the 15 hp. unit. The third week it took the place of the east 50 hp. unit, and the fourth week the procedure was repeated as above described. This system allows the operation of each unit for two weeks steadily with the following week idle. It also makes necessary the operation of all valves at stated intervals, keeping them in working order. The increased cost per thousand gallons of water pumped by using the spare 50 hp. unit for suction purposes requiring only 15 hp. is negligible.

The present capacity of this station is 720,000 gal. per day, allowing four hours' settling treatment for each tank. The addition of a fourth settling tank and using the spare 50 hp. unit to fill two tanks at the same time will increase the capacity of the plant 33 per cent as the spare unit, when used for suction purposes, pumps water at the rate of 1100 gal. per min.

Plans and specifications for this station were prepared under the general direction of G. J. Ray, chief engineer, and F. L. Wheaton, division engineer, and under the personal direction of D. R. Young, assistant engineer of the Lackawanna. F. J. Nies, architect, prepared the building plans and H. J. Force, chemist and engineer of tests, supervised the treating apparatus. H. M. Warren, electrical engineer, acted as consulting engineer on the general layout. The writer prepared the plans and supervised the construction and installation of equipment.

Raise Coal Chute Two Feet With the Use of 78 Jacks

THE ASSIGNMENT of new Mikado and mountain type locomotives to the Kansas division of the Chicago, Rock Island & Pacific recently gave rise to a troublesome difficulty at the coaling station at Herington, Kan. The tenders of the new locomotives are so much higher than those provided for the older types that the aprons from the coal chute were too low to deliver coal satisfactorily to the newer engines. A study of this difficulty led to a plan for jacking up the entire coal chute a distance of two feet, which, because of the character of the structure and the large area it covered, necessitated the use of 78 jacks operated simultaneously by a gang of nearly 100 men.

The coaling station is of the elevated incline trestle type with a bin capacity of 600 tons in 40 coal pockets arranged in a double row along the two sides of the structure to serve two coaling tracks. An average of 40 locomotives are coaled a day, requiring about 9,500 tons of coal per month. With the coal aprons too low for the engine tender the ends of the chute would descend a considerable distance into the coal pocket of the tender so that long before the tender was loaded the coal backed up into the chute and had to be shoveled off, causing delay in loading and the spilling of coal on the ground. After considerable study it was decided that the only solution would be to raise the entire station two feet.

The first step in this work was to go over the substructure of the chute carefully and remove and replace any worn out and decayed timbers with new ones that would stand the strain of lifting. Jacking blocks were bolted to the timbers under the bin portion and also under the approach trestles. Temporary blocks 8 in. and 16 in. high and permanent blocking 24 in. high were cut and distributed at the various jacking points. After this preliminary work had been completed 74 14-in. screw jacks and 4 35-ton jacks were assembled from the various divisions. On a Sat-

urday the chute was emptied of coal and the gangs were moved into the terminal to be ready to start work on Monday. At 8 o'clock Monday morning the jacks were put into position at 74 points under the bin structure with the four 35-ton jacks under the power house. The trestle portion of the structure was cut loose from the main building and when all was in readiness one man was assigned to each of the jacks with six men to handle the four large jacks.

When all was in readiness one man gave the signal and all jacks were turned up the same distance, the chute raising from its foundation at the first turn. This was repeated until the jacking was completed, each man raising his jack the same amount upon a given signal. After the structure had been jacked up eight inches temporary blocking was inserted and the jacks turned back to make another start, after being placed on eight-inch blocks. The operation was then repeated until the lift equalled 16 in., when the jacks were again released and turned down and 16-in. blocks inserted. When the final lift of 8 in. had been made 24-in. permanent blocking was inserted and the jacks released.

It had been anticipated that it would require one day to raise the chute, one day to raise the incline and one day to place additional bents under the incline. Instead the chute had been raised exactly two feet and blocked up at 3 p. m. of that day and the necessary bents were placed under the incline and the chute again ready for operation at the close of the second day, during which time the locomotives were coaled by a locomotive crane with a clam-shell bucket.

It was found that this work required an expenditure of approximately $1,800, of which $435.49 was charged to material and the balance to labor and the expense of transporting men to and from Herington. This work was done under the general direction of C. C. Cunningham, division engineer with O. W. Taylor, bridge and building foreman at Herington, in direct charge.

A Large Scale Test Record of the Life of Treated Ties

AS THE RESULT of a recent inspection and analysis of renewal records, opportunity has been afforded for an authentic check of the life of an unusually large number of treated ties laid out-of-face in a single stretch of track. While this record concerns ties subjected to a process of treatment no longer used, it affords a measure of the results to be obtained with ties subjected to treatment with equivalent quantities of the same preservatives under rather severe climatic conditions and presents an unusually conclusive demonstration of the value of timber preservation. The ties in question were a lot of 166,097, 6-in. by 8-in. by 8-ft. hewn pine ties placed in the track of the Slaton-Lamesa branch of the Santa Fe in western Texas in 1910 when this line was built. They were treated with creosote and zinc chloride by the Allardyce process at the Texarkana, Texas, plant of the International Creosoting & Construction Company. A chemical examination of the treated ties was made by W. A. Powers, Santa Fe chemist, to determine the creosote and zinc chloride content before any of them were accepted. They were inspected before loading by J. S. Carton, tie inspector for the railroad.

The Allardyce process consisted of a two-movement treating operation wherein zinc chloride solution to the extent of ¼ lb. of dry salt per cubic foot of wood was injected into the ties, being followed immediately by 3 lb. of creosote per cubic foot. The process was effective as far as the treated product itself was concerned, for it combined some of the advantages of both zinc chloride and creosote at a cost less than that of the straight creosoted tie, but its use involved difficulties in plant operation which seriously limit its application, and because of that fact, even at the time of the above purchase the Allardyce process had been abandoned and it has not been used since.

In order to ascertain the service rendered by the ties originally laid on the Lamesa branch, the entire branch was inspected on October 15, 1924, by representatives of the railroad and the company furnishing the ties. The inspection party found the general condition of the track to be such that the majority of future replacements will be required because of excessive checking. Ties check badly in this vicinity, a condition which is apparently due to the erratic rainfall, for according to the government weather reports certain years between 1910 and the present have had over 30 in. of rainfall, while other years have had only 3 in. Some Burnettized ties treated in 1919 and placed in the same track are now as badly checked as the Allardyce ties installed in 1910. The traffic is light and the ties have plates, so there is little rail cutting. The type of construction is such that most of the tie is exposed. The track is built on sand or sandy loam. There are a few short stretches of cinder ballast, but the major portion of the track is not ballasted.

According to the railroad's records 40,880 of the original 166,097 Allardyce ties will have been removed from the track by the time that the 1925 replacements have been completed. This means that 24.6 per cent of the ties will have been removed at the end of 15 years' life. By comparing the well-known diagram appearing in Forest Products Laboratory Technical Note No. 130 with these service figures, it is found that 15 years represents 81 per cent of the ultimate life of this group of ties. In other words, the average life of the ties in this group is 18.5 years, which is about 50 per cent greater than the anticipated life of such ties with this method of preservative treatment.

These ties cost 45.4 cents at the plant, treated. The freight charge was 34.7 cents and the cost of insertion, 18.5 cents, or a total cost of 98.6 cents. With an average life of 18.5 years the annual cost of these ties, i. e., interest on the investment plus the annuity to replace them at the end of their service life is between 8.8 cents and 9 cents per tie, depending on the method of calculation.

The inspection for the railroad was made by R. S. Belcher, manager of treating plants, Topeka, Kan.; J. W. Walter, division engineer, Slaton, Tex., and C. H. Strawn, photographer, Topeka, Kan. The International Creosoting & Construction Company was represented by J. B. Latimer vice-president and general manager, and R. E. Meyers, in charge of the department of chemistry and tests, both of Galveston.

AN INNOVATION IN SERVICE—In Pennsylvania dining cars the name of each waiter is to be shown on the bills-of-fares which are placed on the tables which he attends. The railroad company announces that this practice has been decided on as another step toward the ultimate consummation of its plan to establish more direct, cordial and pleasant relations between patrons and employees. It is thought that the waiters will take greater pride in their work and feel a greater sense of responsibility.

Enlarge Section in Relining Tunnels on The Union Pacific

Extensive Project Now in Progress on the Los Angeles & Salt Lake Unit of This System

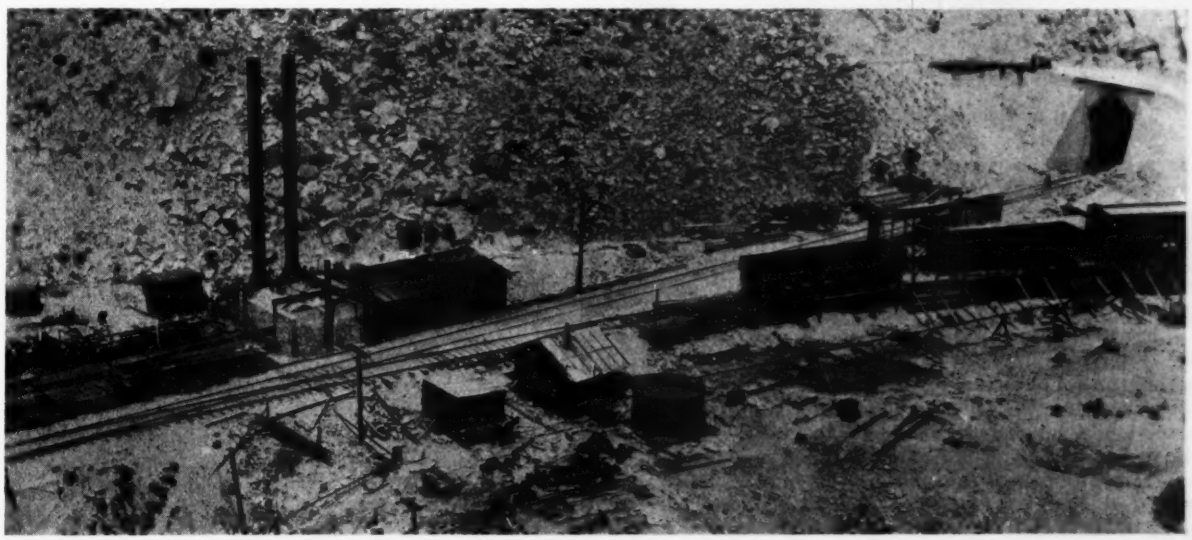
THE LOS ANGELES & Salt Lake unit of the Union Pacific is now prosecuting a program of tunnel relining which calls for the replacement of old timber lining with concrete in 18 tunnels with a total length of 9,200 ft. This plan, which was undertaken about three years ago, calls for an organization to carry on this work continuously and effect its completion in a period of five or six years, the gang being transferred from one tunnel to another as the work progresses.

The Los Angeles & Salt Lake extends from Salt Lake City, Utah, to Los Angeles, Cal. Of the 18 tunnels on this line 16 are located in the Rainbow canyon near Caliente, Nev. East of Caliente are six tunnels driven during the original construction in 1889 which were timber lined in 1900, using native pine and cedar. The original timber is still in place and is in very good condition except where it is in contact with the soil or moisture. West of Caliente are two tunnels driven in 1904 and 10 tunnels driven in 1910 and 1911 during extensive line changes. These were lined with redwood.

Although the condition of the timber was generally good, careful examination indicated that it was rapidly reaching a stage which would call for extensive maintenance work. This pointed to the need of new linings, and because the territory is very dry, introducing the hazard of fire in a peculiarly acute form, the need of a fireproof construction in replacements was obvious. Another important condition presented was the fact that the tunnels had been constructed to smaller clearance than that adopted as standard by the Union Pacific system.

A solution of all the problems presented was reached by deciding to enlarge the bores of the tunnels and re-line them with reinforced concrete designed to withstand all earth pressures. Plans were prepared on this basis and work was authorized for two of the oldest tunnels. These have now been completed and the third is nearing completion. It is expected to complete three more during the next eight months.

The enlargement consists of increasing the width about four feet and the height seven feet. It is, therefore, possible to work behind the old timber, removing the rock and placing new timber before the old timber is removed. This method insures against the hazard of cave-ins and a tie-up of traffic. All drilling is done by air, using jackhammers. A four-foot section is worked out and the new timber placed, if required. Due to traffic, only light shots can be used so that muck can be cleared out at any time a train is due.



The Construction Plant at One of the Tunnels

Experienced miners handle the removal of rock and the placing of timber. The muck is cleared away by hand and loaded in one-yard dump cars hauled by a gasoline motor car. Practically the entire section is lagged and packed with second-hand timber. This is more economical than to use extra concrete to backfill the overbreaks. Packing removed after 30 years was found to be in good condition so no trouble is anticipated from the rotting of this timber.

Wide Variety of Materials Encountered

The formation through this territory is of volcanic origin and in a badly shattered and faulted state. The classification of materials through nearly all the tunnels covers the range from earth to solid rock. The fact that 11 different classifications were made during construction shows the wide variety of problems presented in carrying on the work and providing absolute safety to train operation.

The timbering installed for the tunneling operations behind the old lining consists, in the average shat-

tered formation, of 12-in. by 12-in. segment sets placed four feet apart and covered by two-inch lagging. In earth or heavy ground it is necessary to place the sets closer and use three-inch lagging.

Wooden forms are used for concrete. The side wall forms are built in six foot sections, using 3-in. by 8-in. studs and 1-in. sheathing. These are set first and held in place by eye-bolts spiked to the timbering. Long

The Portal of Tunnel No. 5 Shortly After Relining

lag screws are used in place of eye-bolts where the pressures are light and the timber is sound. The bolts are spaced three feet apart in horizontal rows and take the pressure from lines of double two by six wales which bear against the studding. The side wall forms extend 15 in. above the springing line of the arch so the arch form can be loosened by lowering to clear.

The arch form is built in 12-ft. sections. The ribs are three-ply 2-in. by 12-in. segments bolted and braced to support the 16-ft. span. The arch form is set 5 in. above the side wall form and wedged. After a section is poured the wedges are knocked out and the forms rolled ahead on small pipe rollers supported on the top plates of the two wall forms. A bulkhead is placed against the timbering and concrete placed in 12-ft. sections.

The forms are well built at the beginning so that it is possible to reuse them 15 to 20 times. The face is carefully cleaned and oiled each time the form is removed.

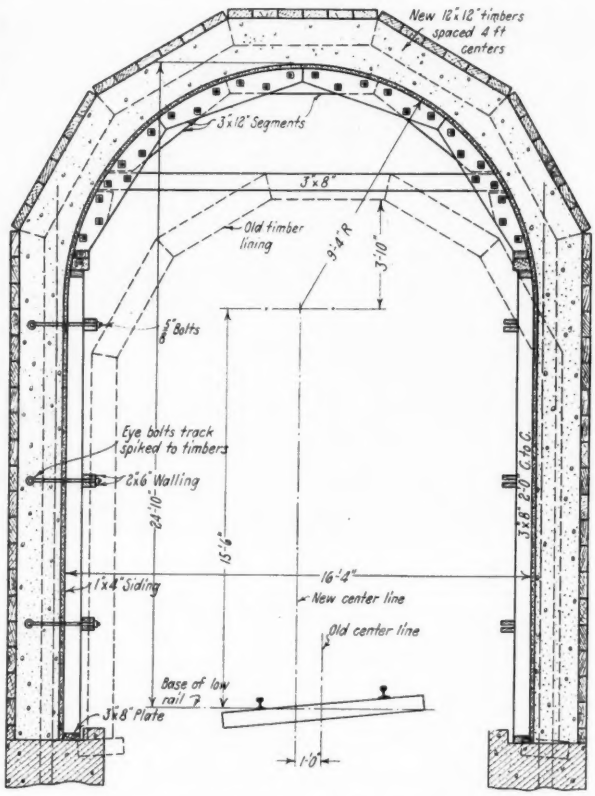
The reinforcing consists of ¾-in. square bars. The vertical bars are spaced 12 in. center to center and the horizontal bars 3 ft. apart. The bars are set three inches from the inside face of the concrete.

The finished lining has a clearance of 16 ft. 7 in. horizontal and 24 ft. 8 in. vertical. The concrete is 22 in. thick with a minimum of 10 in. in front of the posts.

The concrete is placed by a pneumatic mixing and placing machine furnished by the Concrete Mixing and Conveying Company of Chicago. This is set outside the tunnel as close to the lower portal as the topography of the country will permit. Concrete materials are unloaded from an elevated trestle into bins, wheel barrows being used between the bins and the machine. The mixer has a capacity of eight cubic feet per batch. The concrete is conveyed from the machine to the crown of the arch form through a 6-in. pipe line. With a distance of from 600 to 800 ft. from the mixer to the form, a 12 ft. section of barrel, or 50 cu. yd. of concrete, can be placed in four hours. The forms are removed after 48 hours. The machine requires from 1,000 to 1,500 cu. ft. of air at 60 to 80-lb. pressure and handles the concrete at the rate of about two batches per minute.

The work is being done by company forces with a gang of about 75 men who are housed in portable bunk houses set as close to the work as convenient. A boarding house operated by the company furnishes meals to all except a few who have their families close to the work. The camp and work are electric lighted. All necessary power for the work is obtained from two 150 hp. boilers equipped for burning oil. Two 1,000-cu. ft. duplex cross-compound air compressors supply compressed air for the operation of the pneumatic mixer and the drills. Lights are furnished from an 8 kw. steam-driven generator. An auxiliary 2.5 kw. Delco lighting plant is used until the steam plant is installed and while moving the outfit. A steam-driven 42-in. rip and cut-off saw is used to frame all timber.

The work is necessarily delayed somewhat on account of traffic, but train operation is not disturbed



The New and Old Tunnel Sections Compared

except that all trains operate at reduced speed. Signals have been installed that indicate an approaching train sufficiently in advance so that the tunnel can be cleared.

The work is being handled by the engineering department of the L. A. & S. L. unit of the Union Pacific under the direction of H. C. Mann, assistant chief engineer, and the personal supervision of L. P. Drew, bridge engineer. We are indebted to Mr. Mann for the above information.

Winter Concrete Work in Canada

Building Bridge Masonry in Winter

Extended Experience in Northern Latitudes Demonstrates Entire Practicability of Concreting in Cold Weather

By A. M. Bouillon

Engineering Department, Chicago Terminal Improvements, Illinois Central, Chicago

TWENTY years of construction experience acquired largely in countries subject to severe winter climate, 14 of which were spent on the Grand Trunk Pacific in Canada, have definitely demonstrated to the writer that much concrete work can be carried on profitably during the winter season. This was notably the case on bridge substructures requiring river piers which, in all instances where the work was properly handled, cost less than similar work done during the summer. Even in most of the cases where the actual cost of winter work totaled higher, the fact that the plant and the organization were kept going proved to be of decided advantage, especially at points where difficulties might be encountered in recruiting a competent staff when work was resumed in the spring.

The suspension and subsequent resumption of work involve indirect items of cost that are frequently overlooked. They mean temporary disorganization of the staff with consequent loss in efficiency, the cost of storing the equipment which may also require considerable dismantling and later reassembling, the cost of keeping watchmen to look after the stored plant, interest on the cost of the idle plant, insurance on the plant, depreciation, loss of possible earnings on the plant and organization investment, extra office work incidental to the temporary tie-up, etc. These items, when translated into values and totaled, may represent an amount sufficient at least to balance the expected increase in cost, if the work had been carried on during the winter.

It is not the purpose of this article to extol the merits of winter construction to the detriment of construction carried on during mild weather, but to present facts drawn from actual experience with both summer and winter work on the construction of railways with particular reference to bridges at crossings involving the construction of river piers for the purpose of showing that much winter construction has been done for less money than in summer, but that in no case have the results on well managed work shown any excessive difference in the cost.

Winter construction calls for departures from the regular routine. To those unacquainted with its requirements it will seem like going into a new field. Winter construction requires more care in laying out the plant and more constant attention to details of the plant and of each piece of machinery while frost conditions prevail. One prolific source of trouble, which can be traced in most cases to oversight and carelessness is the freezing of water pipes, tanks, etc., which simple precautions might have prevented. These may prove to be costly mistakes which, in some instances, have resulted in tying up the plant until repairs have been made. Beyond certain generalities that

FOREWORD

This is the first of a series of articles on winter construction, including concrete and substructure work. They have for their purpose to show that such construction work can be carried out successfully in the winter, to outline the precautions necessary for good results and to describe methods that proved effective. The author was engaged for 14 years on railway construction in Canada where considerable of the work was carried on through severe winters, notably on substructures and superstructures of bridges on the Grand Trunk Pacific; he was employed also in supervising the construction of bridges on the Alaska railroad, a large proportion of which was likewise carried on during the winter. Obviously, the climatic conditions encountered on all this work were such as to afford an unusually severe test of the methods to be described in this series of articles.—Editor.

will vary according to location, climate and kind of work, no definite set of guiding rules for winter construction can be given, owing to the wide range of climatic conditions that may vary from a rainy winter in some sections to extreme cold in others.

Consider first some of the assumed difficulties and estimated hazards of winter construction that have been put forward as deterrent influences. It has been claimed that winter weather has a retarding effect upon labor efficiency, that men are less active, their movements being impeded by heavy clothing; that slippery footing and ice and snow increase the risk of accidents; that there is greater danger of illness and that attendance to work, particularly of men on portions of the job most exposed to weather inclemencies, is not dependable, with the liability that these intermittent and usually unannounced absences create gaps in the ranks that may greatly reduce the efficiency of the rest of the gang; also that on days of sleet, blizzards and intense cold it may be necessary to tie up the work and probably have the gang employed on unproductive items such as shoveling snow, cutting ice or removing sleet from cables, forms, etc.

It is claimed that all machinery, particularly a gasoline-operated plant, works less efficiently and that tie-ups in some units of the job may happen frequently and cause considerable loss of time with a corresponding increase in production costs. Sleet, which is a factor in some districts, accumulates on cables, pulleys, blocks, etc., at times causing serious havoc, breaking cables, and tying up the work. It is also claimed that cold weather makes it harder to operate machines and hand tools.

Severe Weather of Limited Duration

The above deterrent arguments do not take into consideration the fact that very inclement weather occurs only in comparatively few spells, usually of short duration. Erroneous assumptions too often result from accepting statements of the peak records of cold weather, blizzards and sleet, as the typical winter climate tributary to the district being investigated. In all of the northern states, Canadian provinces and the interior of Alaska, even reaching close to the Arctic circle, spells of extremely severe weather are comparatively infrequent and are not usually of long duration, one to three days being generally the peak period of the excessive cold spells, the degree of intensity of course varying with the location. Usually the weather is calm and in most places only moderately cold, the days bright and clear and the effect of the dry snappy air is exhilarating and unconsciously urges one to activity to overcome the sting of the cold. As a result, during at least 75 per cent of the winter, many of the men employed on winter jobs prefer assignment to outside work rather than in heated enclosures.

On the construction of the substructure for the Susitna River bridge on the Alaska railroad, 225 miles north of Seward, Alaska, which was conducted largely under winter conditions, most of the laborers preferred loading and wheeling barrows of aggregate outside to rehandling concrete within a housed-in heated pier, in spite of the fact that during about six weeks the sun did not rise high enough above the mountains to shine into the valley.

In constructing the substructure of the South Saskatchewan River bridge near Saskatoon, the long Battle River viaduct near Wainwright, the North Saskatchewan River bridge near Edmonton and the Pembina bridge, 60 miles west of that city, all on the Grand Trunk Pacific, work on cofferdams, excavation and concrete was carried on continuously, summer or winter, regardless of climatic conditions. Concrete was placed at temperatures lower than 40 deg. F. Night work was carried on at one of the bridges in order to insure readiness for the steel in the spring and the lowest mark reached on that work was 68 deg. below, registered at about two a. m.

Below are given comparisons of summer and winter construction difficulties encountered on a large bridge in western Canada, that might be accepted as typical of the construction conditions actually encountered on bridges at many of the wide river crossings, in the sections discussed in this article. This example also indicates some of the problems to be expected when planning bridge construction at wide river crossings under similar climatic conditions.

A Concrete Operation Equipped for Winter Work

The Difficulties Incidental to Construction in Summer

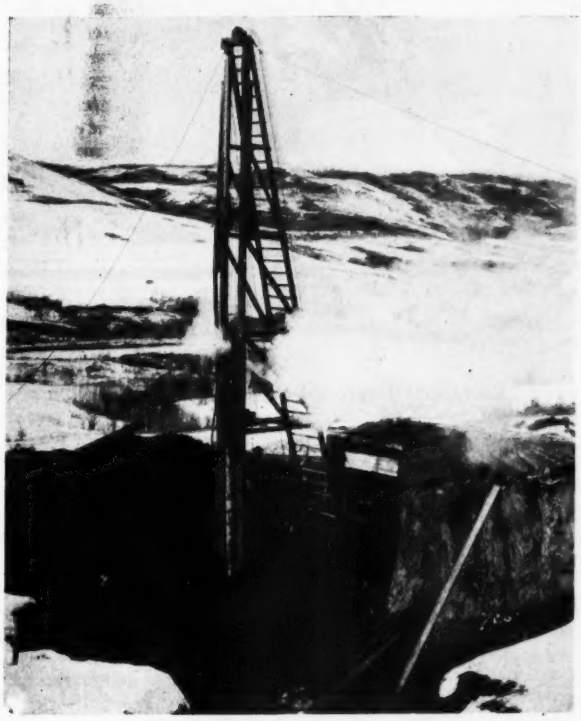
(1) Floods, occurring at unexpected as well as at expected periods brought down uprooted trees and other floating debris, including logs that had broken away from up-river logging camps. The accumulation of these against the works carried away deflecting piers, portions of the caissons and the cross river tramway and caused other damage. The delays throughout the summer season chargeable to such causes totaled about three weeks, including the time consumed in restoring the damage. The cost items incidental to the floods embraced the labor of shoving off the debris from the deflecting piers and upstream sides of the caissons and cross river tramway in attempting to save these structures, removing the plant on the banks above the level of the flood and otherwise attempting to prevent or minimize the extent of the damage. After the flood had subsided came the work of restoration, consisting of removing piled logs and debris from those portions of the cofferdams, deflecting piers and tramway that had survived; pumping out the cofferdam, excavating the mud deposited therein and cleaning away the muck from the sides, and repairing the damaged caissons, tramway and deflection piers. Such mishaps were expensive. They compelled the prompt conversion of well bal-

anced productive forces into hastily organized units to fight the destructive effect of the sudden floods.

(2) Heavy spring and summer rains, while of short duration, hindered progress and at times compelled temporary suspension of work. The total delays from such amounted to three or four days during the mild season. Ordinary rains did not stop the work.

(3) The scarcity of labor generally prevailing during the summer gave rise to strikes and other labor troubles.

(4) Several short periods of extreme heat had a very noticeable effect on most of the men exposed to the sun. These included those employed in excavations, framing timbers, erecting forms and practically on all activities except concreting. Fortunately these heat waves were infrequent and usually lasted only from one to three days. At other periods, mostly in the early fall, mosquitoes, sand flies and other biting pests harassed the men so as to cause a perceptible decrease in their efficiency and production. It was estimated that these retarding agencies, including the effect of heat, contributed to an average man power loss of about 10 per cent, affecting about two-thirds of the employes during the periods when these unpleasant conditions prevailed. This was equivalent



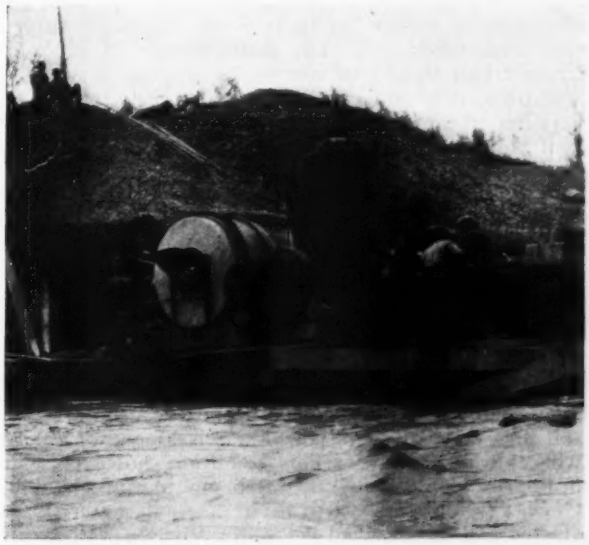
Pile Driving in Winter

to a non-productive period of four days for the full force at full pay during the mild season.

(5) Loss of time due to illness and accidents was greater during the summer than in the winter although rigid enforcement of health regulations resulted in a low percentage of illness in all seasons.

(6) Summer work at river piers required placing some of the equipment, such as pile drivers, and gravel and sand excavation on scows, the moving of which was slow and cumbersome, due to the necessity of anchoring the scows to pile dolphins or to the sides of the cofferdams for each operation. The pile driving and sheet piling done on cofferdams during the summer cost about three times more than that done in winter when the drivers could be moved over the ice. Excavation by derrick and skips cost 10 to 20 per cent more in summer because of the greater delay and expense caused by leakage.

(7) Summer construction required higher cofferdams to provide an ample margin above expected ordinary floods. In rivers which carry logs and floating debris during floods, or cutting ice in the late fall,



Rescuing a Mixer From a Flood

it was necessary to build diversion piers a short distance above the upstream end of the cofferdam that would deflect this debris away from the work. As cited elsewhere in this article even these precautions are not always efficient, particularly against floods of greater magnitude than usual.

Principal Difficulties Incident to Winter Construction

(1) Freezing weather makes it necessary to heat concrete aggregates and to provide housing and heating for such operations as the mixing and placing of the concrete. Heating and housing concrete piers, including heating of aggregates increased the cost of concrete on large piers from two to four per cent, on abutments from 3 to 7 per cent, and on pedestals from 8 to 11 per cent, these figures being the respective averages of several large bridge substructures on railway construction in Canada.

(2) On quiet days with temperatures not lower than about 5 deg. below zero, the average production output per man on outside work is not decreased but is practically at its highest, the same as in the cool days following the first frost of the late fall, for the men are active and work steadily, the slight nip of the cold proving an incentive to exercise, so that they unconsciously accomplish more than the usual summer average. However, when the weather is so cold as to compel men to hamper their movements with heavy clothes, such as happens when the temperature reaches about 20 deg. below zero and also when there is a wind at any temperature below freezing, there is a perceptible slackening in the work of the men in exposed places, but this does not affect men working under shelter.

(3) In some districts, notably in our northeastern states, and in portions of the Maritime and Quebec

provinces in Canada, and along the Great Lakes, sleet is apt to create more trouble, delay and accidents to men and plant than any other winter inclemency. However, it can be quickly removed from the plant, cables, etc., by the careful use of the steam jets if within reach of them. The slippery footing can also be counteracted by a generous spreading of salt, sand or ashes. Fortunately such periods do not occur often and are generally of short duration.

(4) A plant that is unsheltered does not work so efficiently in winter but there is no noticeable difference when sheltered. The water pipes and exposed steam mains should, of course, be properly insulated. The protection and care of the plant in winter is a very important item. Intelligent anticipation will prevent troubles, delays, accidents and the incurring of expense due to oversight and negligence. Boilers and tanks not in actual service should be drained. Water pipes, even though insulated, should in the first instance be laid so that they can be easily drained and disconnected from the supply source. Steam equipment is preferable for winter work, as it is much more dependable than gasoline equipment at temperatures below freezing, and the steam is available for other purposes than running the plant.

(5) The use of explosives is required in excavating certain formations such as frozen gravel and sand, soil and clay, or materials otherwise loose or easily workable in summer. This condition, however, will ordinarily apply only at the beginning of the job. Once a foundation excavation in such materials is started and has reached below the frozen crust, it can easily be protected against further freezing by covering the top with tarpaulins spread over cross-timbers. Ordinarily, this will be sufficient for the average winter temperature but it can be supplemented by heating with stoves at night when the cold is severe. Explosives such as dynamite will require thawing, in which process care must be exercised, as carelessness has resulted in some serious accidents.

(6) The removal of snow and ice will entail some expense but is usually not a costly item.

(7) Heating the premises including the camps will involve some expenditures which will vary according to local conditions and the cost of fuel.

Comparative Costs

When the cost of all construction items for the substructures of one of the big river crossings in western Canada were tabulated for winter and summer work of a comparable nature, it was found that the difficulties incidental to summer work, including losses caused by floods, had increased the cost of the concrete about 24 per cent, whereas the difficulties incidental to winter construction, including heating of aggregates, housing and heating piers and allowances made for delays caused by storms, amounted to about 5 per cent, showing a saving of 19 per cent on the comparable items of that work in favor of winter construction.

Tabulating only the items of cofferdam and excavation on the same basis as explained above and dividing by the cubic yards excavated by derricks and skips applicable to each season the result was still more striking, as it showed that excavation carried on during the mild season, including losses caused by floods, cost 84 per cent more than similar excavation done in winter. These illustrations, of course, apply only to certain river piers where a fair comparison could be made on work which in the north can be handled much cheaper in winter than in summer. However, the construction costs of land piers, pedestals and abutments averaged only about 5 to 6 per cent more in winter than in summer. Taking the bridge substructure as a whole and separating all of the work done in winter and summer on land and in the river the winter work cost an average of about 12 per cent less than the same items done in summer. The saving made on the shore work aided by the good working conditions that prevailed throughout Indian summer after the first frost had killed the insects and the river had reached its lowest stage with no further danger from floods, enabled a substantial decrease in the extra cost of summer work that had been incurred earlier in the season.

In spite of the handicaps that are supposed to hamper winter work it is undoubtedly true that ordinary

Forty-four Degrees Below Zero at 11 A. M.

labor is more efficient, more careful and more productive in winter than in summer. This applies also to carpenters and other mechanics.

As a rule we are inclined to magnify the difficulties of winter construction without considering its advantages and we are also inclined to overlook the disadvantages of summer construction. It is, of course, impossible to outline regulations that will apply to all winter work. Each job will require its own rules according to its peculiar conditions. Each job, whether performed in summer or in winter, has its own peculiar problems, its local advantages and special difficulties. To study the first, adapt the second and curb the last of these conditions, are the particular missions of those who plan and direct the work and whose solutions of the problems will have an important bearing on the results obtained.

THE GREAT NORTHERN and the Canadian Pacific, to eliminate unnecessary duplication of facilities plan to abandon certain portions of their lines in British Columbia, using each the other's lines under a joint track arrangement. The Great Northern proposes to discontinue its branch line from Grand Forks, B. C., to Cascade, 15 miles, using instead the line of the Canadian Pacific. The Canadian Pacific plans to abandon the portion of its line over the Eholt grade from Grand Forks west to Midway and use the Great Northern's Kettle Valley line.

Statistics Show Marked Increase in Wood Preservation

A TOTAL of 62,632,710 cross ties were subjected to preservative processes in 1924, this being by far the largest number of ties ever treated in any one year. It exceeds the total for 1923 by 9,022,535 and is 7,249,195 more than the previous high record of 55,383,515 ties for 1921. However, it is not alone with respect to ties that 1924 was a record year in timber preservation, for in the figures for the total volume of timber treated, quantities of preservatives used and number of treating plants in operation, 1924 stands as the record; in fact, there were notable increases in the volumes of all classes of materials

Cubic Feet of Timber of Various Classes Treated

Classes	1923	1924
Cross ties	160,830,525	187,898,130
Piles	9,569,443	11,685,757
Poles	26,886,904	36,716,768
Wood blocks	4,932,307	4,191,560
Cross arms	420,206	517,811
Construction timbers	18,837,795	24,292,231
Miscellaneous lumber	2,898,288	3,281,979
Total	224,375,468	268,583,235

treated except wood blocks, as compared with last year. In all classes except wood blocks and cross arms the volumes treated in 1924 exceeded all previous records.

These and other pertinent facts on the growth and development of the wood preservation industry are presented in statistics issued by the Forest Service of the United States Department of Agriculture in co-

Wood Preservation, 1909-1924, Together With Consumption of Creosote and Zinc Chloride

Year.	Total Material Treated Cu. Ft.	Number of Cross Ties Treated	Creosote Used, Gal.	Zinc Chloride Used, Lbs.
1909	75,946,419	20,693,012	51,426,212	16,215,107
1910	100,074,144	26,155,677	63,266,271	16,802,532
1911	111,524,563	28,394,140	73,027,335	16,359,797
1912	125,931,056	32,394,336	83,666,490	20,751,711
1913	153,613,888	40,260,416	108,378,359	26,466,803
1914	159,582,639	43,846,987	79,334,606	27,212,259
1915	140,858,963	37,085,585	80,859,442	33,269,604
1916	150,522,982	37,469,368	90,404,749	26,746,577
1917	137,338,586	33,459,470	75,541,737	26,444,689
1918	122,612,890	30,609,209	52,776,386	31,101,111
1919	146,060,994	37,567,927	65,556,247	43,483,134
1920	173,309,505	44,987,532	68,757,508	49,717,929
1921	201,643,228	55,383,515	76,513,279	51,375,360
1922	166,620,347	41,316,474	86,321,389	29,868,639
1923	224,375,468	53,610,175	127,417,305	28,830,817
1924	268,583,235	62,632,710	157,305,358	33,208,675

operation with the American Wood-Preservers' Association. During 1924, 268,583,235 cu. ft. of timber was subjected to treatment as compared with 224,375,468 cu. ft. for 1923, the previous high record. The consumption of creosote in 1924 amounted to 157,305,358 gal., as compared with 127,417,305 gal. in 1923, and 108,373,359 in 1913, the two previous maximums. Zinc chloride was also used in greater volume during 1924 than in 1923, the figures for these two years being 33,208,675 lb. and 28,830,817 lb., respectively, but these totals fall considerably short of the consumption of 51,375,360 lb. in 1921. Petroleum, which is used in increasing quantities in mixtures with creosote, is shown for the first time under a separate classification, the total for 1924 being 11,179,346 gal. Paving oil totaled 1,214,452 gal. and miscellaneous preservatives, 473,207 gal.

Statistics dealing specifically with railroad ties show that of the 62,632,710 ties treated in 1924, 34,593,986 were impregnated with creosote, 7,430,840 with a mixture of creosote and petroleum, 5,238,961 with the zinc chloride-creosote emulsion, 15,344,447 with zinc chloride and 24,476 with miscellaneous preservatives. The number of ties treated with zinc chloride in 1924 is slightly less than in 1923, the increase in the total number of ties treated being almost entirely in ties treated with straight creosote or mixtures of creosote with other materials. Of all ties treated 22,639,097 were oak, 18,857,318 yellow pine, 5,413,337 Douglas fir and 4,475,337 gum. A total of 1,452,355 were adzed, 1,393,867 were bored and 12,952,698 were adzed and bored.

Protecting the Waterproofing on Pre-Cast Bridge Slabs

By M. HIRSCHTHAL
Concrete Engineer, Delaware, Lackawanna & Western, Hoboken, N. J.

PRE-CAST BRIDGE construction is resorted to in order to facilitate construction under traffic so as to delay, as little as possible, the operation of trains over the bridge site. It is therefore necessary to perform as much of the work on the pre-cast sections as is possible and so obviate the necessity of any great amount of labor after these

Placing Asphalt Blocks on a Bridge Deck Built in Place

sections have been placed and thus not impede traffic. For this reason, in recent work along the Lackawanna where pre-cast work was decided upon, the waterproofing and its protection coat were installed in the casting yard at Kingsland to within a few inches of the edges of the slabs, necessitating but little work to complete this important part of the operation.

For some time past, the method of protecting waterproofing by means of asphalt paving blocks of special size has been adopted for structures built in place, in preference to thin concrete slabs, or asphalt mastic, poured in place which was used until recently. The reasons for the adoption of the asphalt paving block in preference to the other two are as follows: The

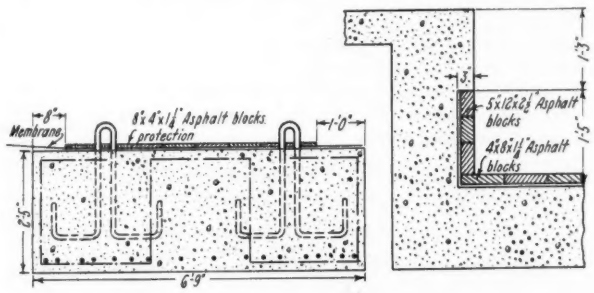
concrete slab protection is generally made from 2 in. to 2½ in. thick, and a slab of that thickness develops cracks due to shrinkage and temperature stresses, which occur even when the slab is reinforced with mesh, although this method reduces the size of the cracks. The water draining through the ballast enters the cracks, freezes and thaws, enlarging them and finally breaking up the thin slab. After repeated operations of this character the ballast is permitted to work its way down and pierce the waterproofing, thus destroying its effectiveness.

This led to the use of a mastic mixture poured in place. This mastic is an intimate mixture of limestone dust, sand and gravel together with asphalt and is itself an added safeguard due to its waterproof qualities. This is far superior to the thin concrete slab, because when subject to traffic it is elastic and will withstand great pressures. The great difficulty, however, is that of obtaining a uniform mix in the field, as the mixing has to be done by hand because of the scarcity of reliable portable mixers suitable for this purpose.

Moreover, in applying the mastic protection, an early start is necessary in the preparation of the heating kettles, while further handicaps are the large space required for equipment, the danger of burning batches with the loss of time and materials, and the additional time required for laying, screeding and setting-up of the mixture before track construction can be started. In addition to this, when not subject to traffic and exposed to the elements, the mastic appears to lose its life and begins to crack up, and when subject to the summer heat, it softens and will flow from inclined or vertical surfaces.

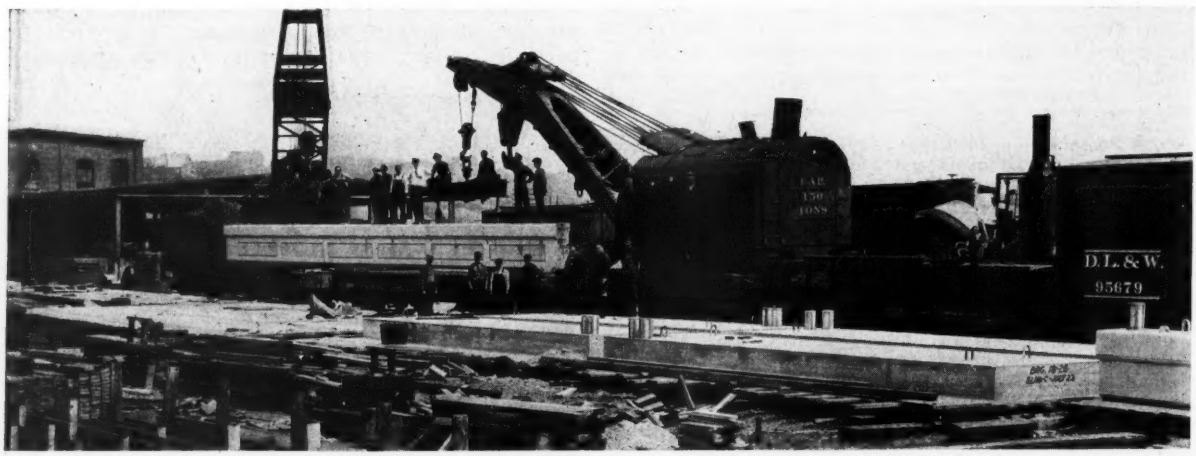
The asphalt block on the other hand has all the advantages of the field-applied asphalt mastic without any of its disadvantages. The block used is 4 in. by 8 in. by 1¼ in., which is a special thickness for this type of work. Its composition is almost identical with that of the asphalt mastic previously specified, both as to properties of constituent materials and their proportioning. The additional advantages are that the blocks are molded under great pressure, increasing their density and hence their bearing capacity, precluding their softening when exposed to the sun to anywhere near the extent of field-made mastic. The method of mechanically mixing all the materials for the blocks with automatic proportioning and timing devices ensuring a uniform product and is an important advantage of the blocks over that of field-made mastic where a uniform product is almost impossible of attainment.

The greatest advantage, however, which is enjoyed by the use of the blocks over that of the mastic poured in place, is that the time required for laying the block is a fraction of that required for mixing, laying and screeding mastic made in the field, and after they are laid permits of track installation almost immediately, while the field-poured mastic requires time for setting before the ballast and track can be installed.



Arrangement of the Blocks on a Slab

When it was first proposed to use blocks for pre-cast slabs, it was feared that in the handling and jarring incident to transferring the slabs from the casting yard to the site of the bridge, the blocks would loosen and slide off the slab and entail double work in the field. It was decided to try it, however, and in actual practice despite unsatisfactory action of the derrick in some instances, but few blocks were loosened. The method has proved very satisfactory and has been adopted for all the pre-cast work as well as for that in place.



Bridge Slabs Before Applying Water Proofing

The process of laying the blocks is similar to that of laying block for pavements, except that on the Lackawanna work the blocks are laid in asphalt with close joints which in addition are flushed with asphalt. After the pre-cast slabs have been set in place on the abutments, the waterproofing fabric which had been bent back is put into position and another layer placed for lapping. The blocks are then laid over the fabric, the joints being flushed with asphalt and the work is completely finished, ready for track laying.

Roadmasters Hold Forty-Third Annual Convention at Kansas City

Excellent Program Evidences Marked Progress Made by This Organization in Recent Years

THE ROADMASTERS' and Maintenance of Way Association held another successful annual convention on September 22, 23 and 24, the place of meeting this year being Kansas City, Mo. While the attendance was not as large as it has been at some previous meetings, the sustained interest in the program was definitely manifested by the uniformity of the attendance at all the sessions throughout the three days of the convention. This convention made a particular record in the high standard set by the committee reports, which averaged high both in the subject matter and the manner of presentation.

Another outstanding feature of the convention was the number of higher railway officers who took part in the program. A. N. Reece, chief engineer, Kansas City Southern, presented a paper on the treatment of soft roadbed and Colonel F. W. Green, vice-president of the St. Louis Southwestern, defined his views on the requisites for a successful maintenance of way officer in a paper entitled "Raising the Standard of Maintenance Forces" during the session on Tuesday afternoon; while L. W. Baldwin, president of the Missouri Pacific, presented an address on Wednesday morning. R. H. Aishton, president of The American Railway Association was also scheduled to address the association but was unavoidably prevented from attending the meeting. The chief feature of the annual dinner, given by the Track Supply Association to the Roadmasters' Association on Wednesday evening at the Baltimore hotel, attended by 450 members and guests, was an address by W. B. Storey, president of the Atchison, Topeka & Santa Fe, L.C. Ryan, Oxweld Railroad Service Company, Chicago, and president of the Track Supply Association acting as toastmaster.

Colonel F. G. Jonah, chief engineer of the St. Louis-San Francisco, St. Louis, Mo., presented an illustrated lecture on the history of transportation on Tuesday evening. In this address he traced the development of transportation from the earliest days down to the modern rail, water and aerial transportation of today. His address was illustrated by a large number of slides prepared from early drawings and descriptions.

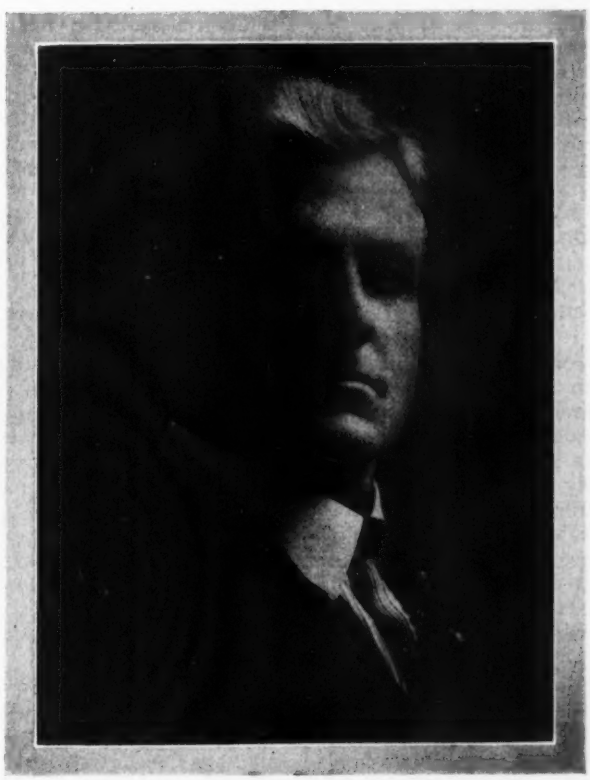
The convention and the exhibit of the Track Supply Association were held in the Kansas City Municipal convention hall, adjoining spaces being provided for these two activities. The exhibit in particular was conducted under more favorable conditions than at any previous convention, since there was not only adequate space to provide large booths for each of the exhibitors, but ample room was afforded for aisles to handle the crowds.

The report of the secretary showed that 90 new members had been taken into the association during the year and that the total membership at the end of the year was 1,023. The report of the treasurer showed a cash balance of $1,151.56.

The following officers were elected at the annual business session on Thursday morning: President, G. W. Morrow, supervisor, New York, New Haven & Hartford, New Haven, Conn.; first vice-president, J. B. Kelly, general roadmaster, Minneapolis, St. Paul & Sault Ste. Marie, Minneapolis, Minn.; second vice-president, J. P. Davis, engineer maintenance of way, Central Indiana, Anderson, Ind.; secretary, T. F. Donahoe, general supervisor of road, Baltimore & Ohio, Pittsburgh, Pa.; treasurer, James Sweeney, supervisor, Chicago & Eastern Illinois, Danville, Ill.; members of Executive committee for four years: C. J. Coon, supervisor, New York Central, Grand Central Terminal, New York, and Earl Crowley, roadmaster, Delaware & Hudson, Oneonta, N. Y.; director for one year: Emmett Keough, assistant engineer maintenance of way, Canadian Pacific, Montreal, Que. Chicago was selected as the place for the next convention.

The following subjects were selected for consideration and report at the next convention:

1. Track joints and their maintenance.
2. The collection and use of cost data by supervisory forces.
3. The rearrangement of track work to promote uni-



W. F. Muff
President

Mr. Muff has been in responsible charge of track maintenance almost continuously for the past 20 years, having been appointed roadmaster on the Chicago & Alton at Louisiana, Mo., in 1904. For the past 16 years, barring a brief leave of absence, he has occupied a corresponding position on the Atchison, Topeka & Santa Fe at Newton, Kan. In point of his connection with the association, Mr. Muff is one of the younger members, having been elected in 1918. However, he has been exceedingly active as a committee chairman, director, vice-president and president.

The Roadmasters at Kansas City

form forces throughout the year.

4. The construction and maintenance of highway crossings and their approaches (including signs) to promote safety.

5. The repair of track tools.

Following the adjournment of the last session on Thursday noon a large part of those attending the convention participated in an inspection trip through the Kansas City terminals, provided through the courtesy of the Kansas City Southern and the Kansas City Terminal Railway. The itinerary included an inspection of the timber treating plant of the National Lumber & Creosoting Company.

The sessions of the Roadmasters' convention were presided over by President W. F. Muff, roadmaster, Atchison, Topeka & Santa Fe, Newton, Kan., assisted by Vice-Presidents G. W. Morrow, track supervisor, New York, New Haven & Hartford, New Haven, Conn., and J. B. Kelly, general roadmaster, Minnneapolis, St. Paul & Sault Ste. Marie, Minneapolis, Minn., secretary, T. F. Donahoe, general supervisor of road, Baltimore & Ohio, Pittsburgh, Pa., and treasurer, James Sweeney, supervisor of track, Chicago & Eastern Illinois, Danville, Ill. The members of the Executive committee were: H. R. Clarke, general inspector permanent way, Chicago, Burlington & Quincy, Chicago; P. J. McAndrews, roadmaster, Chicago & North Western, Sterling, Ill.; R. L. Haring, track supervisor, Long Island, Jamaica, N. Y.; M. Henry, supervisor, Chicago & Eastern Illinois, Villa Grove, Ill.; J. P. Davis, engineer maintenance of way, Central Indiana, Anderson, Ind.; C. H. Gruver, roadmaster, Chicago, Rock Island & Pacific, Manly, Iowa; George W. Koontz, division engineer, St. Louis-San Francisco, Ft. Worth, Tex.; C. A. Joyce, track supervisor, Erie, Paterson, N. J.; J. B. Martin, general inspector of track, New York Central, Cleveland, Ohio (retiring president), and E. T. Howson, editor, *Railway Engineering and Maintenance*, Chicago (honorary).

The convention opened at 10 a. m. on Tuesday morning with an address of welcome by C. E. Johnston, vice-president and general manager of the Kansas City Southern, which was acknowledged in behalf of the association by President Muff. Mr. Johnston's address, the addresses of other railway officers, together with the reports of the various committees, are abstracted below:

The Essentials of Maintenance Work

By C. E. Johnston

Vice-President and General Manager, Kansas City Southern

YOU REPRESENT the roadway and maintenance department of American railroads. Your department deals with the very foundation of the railroad. If a railroad has bad track it is not possible for it to render satisfactory service to the public, and that fact is well advertised, particularly among the shippers and the traveling public. If a railroad has excellent track, and can render excellent service, the shippers and the traveling public also advertise that fact, and the result is that that particular railroad gets the call on the business.

The American railroads spent last year $802,323,000 on maintenance of way and structures, or approximately $2,200,000 per day. Do you appreciate fully the responsibility that rests with the roadmaster to see that a large part of this huge outlay of money is expended properly and with the elimination of waste? Do you fully appreciate the great importance of a meeting of this kind which gives you opportunity to enlarge your scope of thought and vision? It is my view that more thought on the part of roadmasters and practical maintenance men should be given to economies in the salient or larger items of maintenance, such as drainage, rail, ties, ballast and labor.

Since I have been giving thought to my remarks here today it has occurred to me many times that a roadmaster is a fortunate individual. Why do I say that? The answer is simply this—there is inspiration in his particular field of endeavor; there is no limit to his value as a leader, no limit to his value as a "doer." He is never without something, or, in fact, many things to do. There is a call upon him constantly. He can be so valuable and fill such a large part in this great industry of ours.

We all appreciate the fact that rail is perhaps the most expensive item of our track structure. There is an urgent demand upon us as maintenance experts to reduce this very heavy cost. How shall it be accomplished and at the same time maintain the high standard of service required? May I suggest serious consideration to the following:

(a) More consideration be given to the economical limit of wear on the rail before removal. I have thought many times of the very great waste in removing rail not sufficiently worn to justify the heavy cost of replacement.

(b) What is the economical length of rail, and still stay within the limit required to provide for expansion and contraction, in order to provide a minimum number of joints? We all know joints are expensive.

(c) Are we using the proper section of rail to meet the requirements? What I mean by that is are we undertaking to carry more axle load or a greater volume of traffic over our lighter sections of rail, and if

Outside the Convention Hall

we had heavier and well designed sections of rail would the return on the investment in saving in maintenance cost be sufficient to justify the added expenditure?

(d) Are we paying enough attention in the field or on the ground to specifications and inspection of rail? Are we studying the causes for rail failures? Do we have sufficient inspection at the rolling mills?

(e) The maintenance of rail joints is a very heavy item. We perhaps should reason that the fewer the joints the less the cost to maintain the track. The design of the joint and the character of the material in the joint are very important factors.

(f) Do we regard sufficiently the proper allowance for expansion in rail? I refer particularly to an over-allowance for expansion and the effects upon maintenance costs. In my opinion there is no good excuse for running rail or open joints.

(g) This brings us to the item of rail anchors, a very important consideration. At the present time on the Kansas City Southern we are laying 100 lb. rail and leaving the joints free from anchorage. We are, however, anchoring the center of the rail sufficiently, we think, to hold it.

(h) What value lies in the proper cant of rail, and how is the best way to bring this about?

(i) Have you had experience with specially treated rail for sharp curves in order to reduce the wear? We are all familiar with the wear of rail on curves and the resulting expense in changing out such rail ahead of the necessity of changing out rail on tangents, which adds to our labor costs.

(j) Have we carefully weighed the possibilities of a more general use of sawed rail? Many times rail is condemned for main line use by reason of the condition of its ends, due generally to abuses. Many times the section of rail is worn but little when it becomes necessary to remove it from the track on account of the battered ends. Is this not an item of such importance that we can well afford in many instances to extend the practice of sawing off the ends and redrilling the rail and applying new joints, in order to get the life of the rail in main line service? On the Kansas City Southern we have gone into this feature quite extensively and in my opinion have saved our company considerable in the application of sawed rail. In connection with sawed rail, our method has been to take the rail up and haul it to a rail sawing and drilling machine located at a terminal, and when sawed and drilled it is returned to the track and relaid. This procedure involves extra cost of labor in handling. For some little time I have been working with a concern looking to the designing of an appliance that would enable us to saw the rail and drill it in the field without the cost of handling and with considerable less labor. We hope to get this arrangement perfected in due time.

(k) Another consideration of economy in the maintenance of rail is the application of complete new joints in advance of rail replacements. Many times it is possible to improve track conditions and prolong the life of rail greatly by complete renewal of the joints.

(l) Elimination of causes for surface and line kinks to prolong life of rail. You are all entirely familiar with this important item and in my opinion it is possible by careful supervision to avoid many of the surface and line kinks which eventually cause the condemnation of the rail.

(m) Perhaps one of the greatest economies to be realized in the maintenance of rail is the practice or method of laying rail in the first instance. I am not a believer in speed in laying rail. Speed many times operates as a boomerang. There is no comparison, in my opinion, of the return to be derived from a careful and proper job of rail laying and in that item alone is found great economy or great waste. Damage to rail by causes other than ordinary wear and the elements is of paramount importance. It reflects many unfavorable suggestions. It may be mis-management, or it may be one of several other causes such as lack of funds, ignorance, indifference, carelessness, poor maintenance practices, etc. This waste, and I think waste is the proper classification, should be minimized.

Next let us consider switch and cross tie renewals, another large item of expense in the maintenance of track. Frankly, the absolute waste occurring each year in this respect is a reflection on our ability to curb it.

If my views of the situation are not sound, please answer this question. Why is it the average annual tie renewals over a period of years on a certain main line railroad is, say 100 ties per mile, and on another main line railroad in the same section of the country and under similar conditions as to climate, axle load, traffic density, etc., is, say 300 ties per mile? There may be good and sufficient reason for a part of the wide difference but I am unable to justify all of it. What then causes me to think of waste? Under such circumstances is it not consistent to suggest your serious consideration of these important features in connection with renewal of ties?

(a) Are you using the kind of ties most suitable for the particular service requirements and are they purchased under the proper specification?

(b) The size of ties used is very important.

(c) The inspection of ties in advance of application should be watched very closely.

(d) Inspection of ties in track in advance of renewal is an item that cannot be over-estimated.

(e) Tie plating to prevent mechanical wear prolongs the life of ties.

(f) Proper adzing of ties saves money.

(g) What is your loss each year in your maintenance account due to split ties and what have you done to curb this evil?

(h) How much damage is being done on your railroad, or your territory, in the improper spiking of ties?

(i) I have noticed in my experience the loss due to improper piling for storage of ties. Perhaps they were not protected from fire, or perhaps they were carried away by flood.

(j) There is another frequent loss in this material due to carelessness on the part of other departments taking good ties for other purposes. I have seen shipments of freight blocked in cars with first class cross ties. I have seen them used in a number of ways other than the purpose for which they were purchased.

(k) Are we carrying too many ties in our stocks and overlooking the heavy interest on the investment together with the liability of loss?

(l) What attention is being paid to an effort to secure properly seasoned ties in advance of application? Perhaps a smaller item would be improper spacing of ties and the application of more ties per panel of track than are actually required.

(m) In what way are we protecting our joint ties from the effects of rail running? When we consider the very heavy investment in the item of ties per mile of track, the limited life of the material and the labor involved in renewals, a saving of a very small percentage of the total cost, if it could be accomplished by this organization, would more than justify your entire time and expense.

Another important item in the maintenance of track is that of drainage. We all know the effect of improper or insufficient drainage and in this section of the country we are all familiar with the soils, which are particularly unsuitable for economical track maintenance. We find it necessary to provide artificial drainage. We on the Kansas City Southern have tried many different methods of providing sufficient and necessary drainage and think we have paid particular attention to the proper cut and surface ditches.

Our greatest difficulty seems to have been in water pockets in the roadbed, and to meet that condition we have had much experience with such forms of treatment as—

(a) Insertion of tiling.

(b) Application of impervious material such as oyster shell.

(c) The installation of rock drains and trenches.

We have installed tile in many different forms and in practically every instance we succeeded in getting prompt relief. In many instances, however, the relief was not permanent, due to failure of the lines, caused by the saturation in the roadbed and the moving of the ground which eventually broke our lines. On the whole perhaps 50 per cent gave us permanent relief. We have undertaken to cure water pockets by filling them over with impervious material such as oyster shell, and in many minor cases have succeeded, but do not recommend it in extreme and aggravated cases. Lastly, we are treating our water pockets in roadbed with rock trenches and find permanent relief in such methods providing a sufficient size and depth of trench is installed. The trenches, or course, are filled with rock.

We have all made the mistake of undertaking to maintain first class track with the resulting expense necessary to do so, over water pockets. I think this is a needless waste of money and reflects in our maintenance costs. Let me urge more attention be given to the fundamentals, and in this instance the foundation of our track. Once we get a good roadbed under the track we can hope to maintain good track over it most economically.

Let us now consider briefly the item of ballast. While I can appreciate that in most organizations the roadmaster has nothing to do with providing funds necessary for additions and betterments, and in many cases ballasting involves additions and betterments expenditures, on the other hand the roadmaster is depended upon largely to recommend the ballast, to find a satisfactory material and to apply it properly. It is impossible to maintain a standard main track most economically in most sections of our country and make it serviceable for the traffic requirements, without the use of ballast. Ballast improves the riding qualities, preserves rail and ties, and reduces the cost of labor. In my opinion it would be a great error of omission if roadmasters did not fully appreciate their responsibility in calling to the attention of their superiors those items which will bring about economies in track maintenance, and the item of ballast is one of them. Let us think more of ways and means to reduce the $2,200,000 daily expense on American railroads in the maintenance of way and structures.

I have purposely left the most important item until the last—labor. Perhaps we on the Kansas City Southern do not have the complex labor problems that others experience, in that we have a fairly satisfactory source of supply, and further, we deal largely with native labor. I think I understand the difference between native labor and foreign labor.

In a few words and boiled down to the essence of the thing, I think our greatest asset, if we have assets, is in leadership. What is an army of railroad workers without leadership and the forces properly organized? I do not mean labor organizations, but organization of your forces with the proper leadership to perform work—not to wave a red flag. What are we doing to improve the strength and ability of our leaders? I honestly believe that our foremen reflect the characteristics of the supervisors over them, and carrying that further, I honestly believe our laborers reflect largely the characteristics of their foreman.

Labor turnover costs are heavy and in that lies opportunity for improvement. Whereas a certain percentage of turnover is normally to be expected, in any industry, the needless waste of human effort and money entailed in the hiring, training and discharging of employees who do not yield a satisfactory return on their investment is astounding in its magnitude. Recent estimates place the economic loss due to labor turnover in the United States alone at a billion and a half dollars annually. The principal items entering into labor turnover are:

1. Clerical cost of hiring and firing.
2. Breaking in or instruction of new men.
3. Decreased production of new man until proficient.
4. Spoilage of materials and damage to machinery and equipment.
5. Cost of idle machinery and unused equipment.
6. Increased accidents, either to the employee himself, or to others.

Various investigations have been made to arrive at cost figures for labor turnover in different industries. In the shoe industry, for example, a comprehensive study shows that it costs $576 to train an inexperienced man for cutting upper leather in a well-managed shop; for a semi-experienced man the cost is $450.

It costs $302 to train an apprentice to deliver normal production on outersole cutting. To install a skilled worker in a different shop costs from $24 to $50.

The replacement cost of workers will depend chiefly on the specialized knowledge and skill required for the job. In one machinery plant it costs between $50 and $100 to replace a fairly efficient employee. In a large automobile plant, $77.25 is the average replacement cost. The estimated cost for training a new operator in a wire factory is between $100 and $125, while $75 was found to be the cost of replacing a man in a radiator and boiler factory. A railway motorman costs between $200 and $400 before he becomes really efficient.

From an analysis of the estimates obtained in many plants throughout the country, it is found that the average replacement cost per worker in industry is about $50. Labor turnover, therefore, is an extremely important item in direct overhead. It should further be considered in its relation to other payroll losses. Production schedules and plant spirit are injured by a constant stream of new workers. It is therefore necessary to build up a backbone of efficient, permanent employees, if production costs are to be kept at a low figure.

The whole subject of labor turnover requires careful study in each case. Proper selection, supervision, working conditions, home environment, incentives, ages, and mental attitude are factors. In addition, new workers require proper guidance and constructive education in order to be developed into loyal employees.

I have said something of the cost of labor turnover and I have stressed the importance of leadership. I am now talking to the men who have to do with this important item of cost in the maintenance of our American railroads in an effort to impress upon you the fact that it rests largely in your hands to bring about economies in the handling of labor. What I think we need today more than at any other time is far-sighted, clear-thinking and close-fisted men.

The Treatment of Soft Roadbed

By A. N. Reece
Chief Engineer, Kansas City Southern

SINCE the beginning of railroad construction, there has been keen competition between roads. In the early history this competition was principally for the acquisition of new territory. Today, the keenest competition is for business. With the existing restrictive regulation and aggressive competition, the very existence of a railroad is dependent upon the handling of its affairs with the greatest economy, its sole product being transportation. The traffic that a railroad may handle is dependent upon several factors, the most important of which are: (1) its location, (2) its ability to render prompt and efficient service, and (3) its traffic solicitation.

The ability of a railroad to render prompt and efficient service is probably the most important consideration of all. This demands a well maintained and uniform track condition. In fact, one of the foremost railroad men of today has said that the transportation officer is entitled to good track on which to operate his trains, and unless provided with this facility his efforts will be greatly handicapped, with a resulting increase in cost of operation. One of the severest tasks with which a roadmaster or section foreman has to contend in the maintenance of uniformly good track is the existence in certain sections, or over certain stretches of track, of soft spots which frequently require daily attention in order to maintain suitable track conditions.

Causes of Soft Roadbed

Undoubtedly most track men have, for various reasons, cut across roadbeds in both fills and cuts where soft spots occur, and have a clear understanding of the conditions obtaining. Probably the condition most commonly encountered in such an examination of a roadbed cross-section is the bowl-shaped depression under the roadbed, the stratum forming the bowl of impervious material which contains water being covered with various strata of fill material, such as cinders, rock, dirt, etc. The structure forming the bowl, which contains the moisture or water, is usually found to contain marked depressions immediately below the ballast section under each rail with a conical projection near the center of the track.

The principal cause of soft spots in roadbed, either in cuts or fills, is improper drainage. This may have been occasioned by the stopping up or breaking of water-bearing strata immediately under the surface of the ground on which the embankment, or through which the excavation for the roadbed, is constructed. In any event, the water becomes impounded beneath the roadbed. The material causing this impounding is usually a decomposed shale, such as gumbo, hard-pan or clay. Under the action of the pounding of traffic, this material pulverizes and, with water, forms a paste which obstructs even the naturally sluggish percolation of water through it, forming an almost water-tight pocket to which it is essential to afford some method of effective drainage before track can be kept in either line or surface. Ballast applied where such water-pockets exist does little good, since it sinks into the plastic material and makes the water-pocket larger and harder to overcome. Until these soft spots are drained or completely filled with material that replaces the plastic or saturated substance, they require frequent resurfacing and almost constant attention.

Soft roadbed does not always exist in the form of soft spots, since in embankments it may develop into slides, or cutting through water-bearing strata on a hillside and blocking the passage of water, may develop a slide in the cut section, which in either event requires remedying. In the ordinary handling of slides, the section foreman is usually furnished with material for making temporary repairs which are often of a make-shift nature, and the cause of the trouble is not corrected but is put in such shape as to bring further trouble of a more extensive nature.

Treatment of Soft Roadbed

Engineers insist that the most important requisite in the maintenance of good track is a perfect system of drainage. The importance of proper drainage and its effect on track maintenance is not always given the consideration it deserves. If a better realization were had of the necessity of adequate drainage, the expense of maintaining track could be materially reduced in many instances. Assuming that soft roadbed is due to improper drainage, then its cure or treatment resolves itself into applying a system of drainage that will release the water or excess moisture. This is essential to cure this condition.

Many makeshift attempts have been made in the early

stages of operation of new lines to cope with soft roadbed conditions, which can hardly be considered as treatments of these conditions. These will be passed over without comment other than merely citing some of the temporary expedients resorted to, such as the laying lengthwise under the track structure of old ties or slabs from sawmills, and the use of trees and rocks. In many instances soft spots were filled with cinders, which usually increased the soft area and at best gave only temporary relief.

Mr. Morrow is a supervisor on the main line of the New York, New Haven & Hartford between New Haven, Conn., and New London. He has taken a keen interest in the activities of Roadmasters' Association, serving as chairman of the committee which reported on labor saving devices at the 1922 convention. He has also been identified with the Metropolitan Track Supervisors' Club of New York, serving as president of that organization in 1921-22. He is representative of the younger men of technical education who are choosing track maintenance for their careers.

G. W. Morrow
First Vice-President

Cross and Lateral Rock Drains

For several years two general methods have been widely recognized for the treatment of soft roadbed. The first of these is the construction of cross and lateral rock drains; the second, the installation of a system of drainage by the use of vitrified clay pipe. Cross drains are used principally in fills, the practice being to excavate through the entire roadbed or one side of the embankment to a depth below the affected area, the excavated section ranging in width from 4 to 10 ft., and of varying depth, depending on the depth to which the roadbed is saturated. These trenches are then filled with rock or one-man stone, conforming to the roadbed section and extending, ordinarily, to the base of the ballast.

Lateral drains are better adapted to cuts, trenches being excavated at the end of the ties. The general practice is to excavate a trench on each side of the track, extending the full length of the affected area, these trenches averaging 6 to 8 ft. in width and not less than 4 ft. deep, many times extending to a depth of about 8 or 9 ft.

The trenches should be filled with boulders or one-man stone to a point near the sub-grade or base of the ballast, and as a finish, to prevent their stopping up with loose dirt, the top 6 to 12 in. should be filled preferably with good, clean cinders. After this work is completed, a drainage outlet should be provided, in the form of a trench filled with rock or a tile line extending to a natural outlet beyond the end of the cut. While it is not always possible to drain water from the ends of lateral drains, it is desirable to provide these outlets since the most satisfactory results are obtained in that way. However, if sufficient weight is added to lateral drains on each side of the track to confine the soft material, it will generally eventually form a stable roadbed. This system of rock drains serves not only to carry away the water confined in the roadbed, but also acts as a bracing to retain the plastic material under the track structure, and such systems properly installed have given very satisfactory results.

Tile Drains

To insure good results from tile drains, it is essential that they be properly installed. First, an investigation should be made to determine the depth of the saturated material. This can best be accomplished by digging test holes. After this is determined, the drainage system itself should be laid to grade, with sufficient drop to allow the water to drain off readily. A fall of two inches in the main lateral drain lines is considered the minimum drop practicable.

Another important feature in the installation of tile drains is to place the main lateral as far back from the track as possible in order to get it outside the affected area so it will not be heaved out of position by the action of traffic passing over the soft material. Lateral drains should be laid at least 12 to 24 in. below the lowest point affected, with tee-joints spaced from 20 to 50 ft. apart, from which cross drains are laid under the roadbed to tap the sections containing water. To be effective, these cross drains must tap all areas containing moisture.

After the trenches have been excavated and the tile installed with open joints, the drain lines should be filled, preferably with engine cinders. On the cross drains, the cinder filling should be carried up to the sub-grade or base of the ballast. On the lateral drains it is advisable to carry the cinder filling 12 to 24 in. above the tile, leaving sufficient room to complete filling with excavated material in order to permit maintaining the track ditch over the top of the laterals.

With single track, one lateral is ordinarily sufficient, with cross drains extending under both rails. However, where two or more tracks cross the affected area, it is advisable to place a lateral line on each side of the roadbed. The size of tile used depends on the length of line to be constructed, and in any event should be not less than 6 in. in diameter, and preferably 8 or 10 in. Cross drains should be 4 to 6 in. in diameter. It has been found that bell-end tile serve better than farm tile.

The success of such a drainage system is dependent upon carrying out the work under a well planned program, and laying the drains to a grade line that will afford drainage of the main laterals. In climates where

Mr. Kelly has been a member of the Roadmasters' Association since 1915 and has taken an active part in the work of the association. He has had a long experience in maintenance of way work. Following a thorough training as a section and extra gang foreman he served for nearly 17 years as a roadmaster, first on the Minneapolis & St. Louis and later the Minneapolis, St. Paul & Sault Ste. Marie, and 6 years as assistant general roadmaster before his advancement to general roadmaster of the latter road, the position he now holds.

J. B. Kelly
Second Vice-President

frost extends to a considerable depth, the tile must be placed below the frost line; and as heretofore stated, in order to insure proper functioning, the tile lines must be located in solid material beyond the affected area where they will not be subject to heaving from the action of traffic over the roadbed.

Other schemes for the treatment and cure of soft roadbed conditions may have been developed in different sections of the country with equal success. However, both of the methods herein described have been employed with gratifying results and have demonstrated their practicability by the general use made of them.

In the preparation of this paper, no attempt has been made to discuss roadbed constructed over bog or marsh land, or other conditions of such deep-lying faulty formation as to produce a roadbed structure that will in many instances give very serious trouble, and require special consideration for its treatment. In some instances very elaborate systems of special protection work, or the substitution of an artificial roadbed to bridge such places, is necessary. These conditions, we feel, are beyond the intent of the subject assigned.

The Programming of Section Work

THE PRACTICE of programming section work, at least on each local section, is not a new idea, for our experience has taught us that our best section foremen plan their work for weeks, months and even a year ahead. But the subject now being considered is to effect greater efficiency by obtaining more uniform and economical maintenance and thereby avoiding the losses that accompany the general practice of haphazard method, and to stimualte the interest of the foreman by permitting him to plan with the supervisor or roadmaster the work to be done throughout the year. This will have a tendency to speed up the work in many cases in order to meet the program as laid out, and will, also, create a certain amount of competition between foremen.

To program section work successfully consideration should first be given to the establishment of standard methods for obtaining results in the most economical and efficient manner, and to the unit cost of all work to be programmed. This unit cost varies in different parts of this country and even on different divisions of the same railway system, being determined by various items such as the class of ballast, of rail, traffic interference, etc., as well as by the class of labor and the various labor saving devices in use. For this reason it is our opinion that each roadmaster should first standardize the methods of performing each kind of work in so far as it is possible to do so. In doing this a more uniform and satisfactory result is obtained. After this is done it will be easy to arrive at the unit cost of each kind of work, either by a time study of the work as it is being done by the most efficient gangs or by a system of daily reports from each foreman on which he records the cost of certain items of work in man hours.

Mr. Donahoe is now completing his first year as secretary of the association and like a number of his predecessors is an ex-president. Mr. Donahoe became a member of the association in 1910 and was elected president in 1913 and presided at the convention in Chicago in 1914. He was elected treasurer in 1921 and continued in this office until his election to the secretaryship last year. Mr. Donahoe is identified in railroad service as general supervisor of road of the Baltimore & Ohio at Pittsburgh, Pa.

T. F. Donahoe
Secretary

In order to divide the work to be done on each section throughout the year more equally, it is suggested that the territory to be maintained by each section gang be equally proportioned, taking into consideration the various classes of main tracks and branch lines, the switches, crossings, side tracks and ditches, and any unusual or chronic condition that demands additional attention. In A. R. E. A. Bulletin 275, for March, 1925, is a table of values derived from actual costs extending over a period of years on a main line division which was the subject of special study and on which it was found that one mile of first main track is equivalent to:

1.15 miles of second main track.
1.33 miles of third or fourth main track.
2.00 miles of branch line track.
2.00 miles of passing and thoroughfare track.
3.33 miles of yard tracks.
12 main line switches.
20 side track switches.
10 railroad crossings.
12 city street crossings.
25 to 50 county road crossings.
½ mile track pans.
4 miles of ditches.

By the use of this table, or one arrived at through tests on each division where the local conditions and various elements of track can be taken into consideration, the equated mileage for each section can be deter-

Mr. Sweeney is one of the oldest members of the association, having joined in 1892. He has long been active in its affairs, having served as second vice-president in 1902, first vice-president in 1909 and president in 1910. Following the completion of his terms of office he has maintained his activity in the society and has done much to stimulate discussion on the floor. Mr. Sweeney has served for many years as supervisor of track on the Chicago & Eastern Illinois at Danville, Ill. He is also an active member of the Maintenance of Way Club of Chicago.

James Sweeney
Treasurer

mined. This will permit uniform allotment of labor and should result in the accomplishment of uniform maintenance conditions. When these matters have been given due consideration one is in a better position to program section work.

A program should be made for each individual section. This is to be accomplished by a careful inspection of each section by the roadmaster or supervisor in company with the foreman, before the season's work is to begin to determine the things that are to be done and the relative importance of each. At that time, while on the ground, a record should be made of the work to be performed, this record to be taken into the office and a program prepared, a copy of which is to be sent to the foreman. This program can be made so as to arrange for the various kinds of work to be done in the seasons of the year that are most suitable. On the southern lines it is desirable to get all track work which necessitates disturbing the roadbed done during the early spring or in the fall in order to avoid the danger of sun kinks. In fact, practically all classes of track work in the South can be carried on throughout the winter, as very little trouble is experienced from freezes, whereas in the northern climate nearly all track work must be done between April 15 and November 1. The best time to do ballast work and to make tie renewals in any climate is in the spring when the earth has more life to it and such work will hold better.

In the preparation of the program there are certain general items that can be done on each section at approximately the same time. This will enable the supervisor or roadmaster to keep a better check on the results by easy comparisons. These general items include:

1. Annual tie renewals which should begin as early in the spring as the weather conditions will permit. At least 75 per cent of the renewals should be completed by July 1.
2. Such rail replacements as are to be made by section forces, i. e., the changing out of curve-worn and battered-end rails, can be done at any time of the year when traffic conditions are most suitable.
3. Ballasting out of face should be started as early as possible in the spring and completed by July.
4. Although some carriers designate one or two days of each month for tightening bolts and setting down spikes, it is believed that better results can be obtained by having each section gang do this work out of face over the entire section twice each year, in March and September.
5. Cutting right-of-way is to be done as early in each year as the growth of vegetation demands; however, the most effective time for a thorough cleaning of the right-of-way is in August when the sap is the highest.
6. The cleaning of ditches gives better results when done just before the wet season, or during October and November.

In addition to these general items which should be arranged on the program with due consideration to the local conditions, a number of special items pertaining to each section are to be considered. A proper record of these items of work should be made at the time of the inspection and a time set for doing them and arranging them in the program to best meet the requirements of a uniform force throughout the year. However, it will be necessary on some roads to give thought to the prospective labor allowance. A few of these special items are:

1. Fence repair and rebuilding.
2. Switch tie renewals.
3. Yard or side track repairs.
4. Repairs to unusual or chronic conditions.
5. Station grounds.
6. Cleaning ballast.
7. Weak conditions that are to be eliminated by permanent improvements.
8. Other conditions that will be found during inspection.

As far as this committee has been able to ascertain there is only one railroad, the Illinois Central, that has given any great amount of study to the programming of section work, and it has been practiced extensively on but one district on this road. However, the gratifying results obtained on this district during the past two years proves without a doubt the advantages to be gained by programming the work. On this district the supervisor, accompanied by the roadmaster, makes a thorough inspection before the season's work begins to determine the work to be done. On this inspection they, in company with the foreman, walk over each section, making notes of the various conditions to be remedied. At the end of each mile they stop and discuss with the foreman the relative importance of each item that has been noted on that mile, and the date for each class of work is decided upon. After the entire division is covered in this manner, the notes are taken to the office and a program is prepared for each section, a copy of which is sent to the foreman. The foreman is then required to devote his time each day to the work that is assigned on the program with reasonable allowance for emergency work.

In the establishment of standard methods and the determining of the unit cost for various classes of work it will be necessary to require daily reports from foremen conducting the test. The forms for these reports can easily be determined by each roadmaster in order to meet the requirements of all local conditions. However, we appreciate that additional reports are a burden to the average section foreman, and realizing the unsatisfactory results that result from unnecessary reports, we recommend that after the determination of the necessary unit costs has been completed, foremen be required to make reports only once a week concerning the work accomplished as covered by the program, these weekly reports to supplement the usual reports that are required to keep district officers posted on expenditures.

We are of the opinion that no single factor has a greater influence on the efficiency of maintenance of way work than that of programming it in such a manner that it can be carried on systematically throughout the year. Therefore, the work planned on each section's program should be arranged so as to employ as nearly as possible a uniform average section force the year round. Steady employment is an incentive for a better class of labor, and will result in efficiency.

In order to avoid any interruption of the program the matter of requisitioning material must not be overlooked. This is to be done in sufficient time to have the desired quantity on hand at the time the work is to begin.

It is of utmost importance that the program, when properly prepared, be adhered to as closely as possible, for if deviations of apparently unimportant details are permitted, the entire program will lose its effectiveness through other and more serious interruptions.

With the ever increasing demand for economy in track maintenance, the "programming of section work" is destined to become of tremendous importance.

Summary

(1) Give consideration to the establishment of standard methods and unit costs.

(2) Proportion the territory to be maintained by each section force equally.

(3) Carefully inspect each section to determine the things to be done and the relative importance of each. (To be done by the roadmaster or supervisor, accompanied by the foreman.)

(4) Prepare a program for each individual section,

conforming to the general items on the division and providing for the care of special items covering local conditions.

(5) Arrange a system of daily reports during the establishment of standard methods and unit cost. When these have been determined require only weekly reports on work accomplished as covered by the program, avoiding any unnecessary reports.

(6) Program the work as nearly as possible so as to employ a uniform average section force the year round.

(7) Requisition material in sufficient time to have the desired quantity on hand at the time the work is to begin.

(8) Adhere closely to the program.

Committee: W. C. Pruett, district engineer, M-K-T, chairman; P. J. McAndrews, roadmaster, C. & N. W.; J. B. Martin, general track supervisor, N. Y. C.; G. H. Watson, division engineer, B. & M.; H. L. Stein, roadmaster, C. B. & Q.; F. S. Purdy, general track inspector, A. T. & S. F., and W. E. Robinson, roadmaster, F. E. C.

Discussion

The discussion of this report centered almost entirely on Paragraph 6 of the conclusions, which was objected to by William Shea (C., M. & St. P.) and J. B. Kelly (M., St. P. & S. S. M.) who contended that it was objectionable for two reasons: First, that uniform forces throughout the year were impracticable in territories having severe winter weather and, second, that it could be used to support legislation prescribing minimum winter forces. This position was opposed by P. J. McAndrews (C. & N. W.); D. O'Hern (E., J. & E.); A. M. Clough (N. Y. C.), and others, who pointed out the paragraph contained the words "as nearly as possible" and that there was nothing in the paragraph to specify or otherwise indicate what a minimum force should be. Furthermore, it was pointed out that the idea of the committee in advocating more nearly uniform forces was that any increase in the force employed in the winter would be offset by corresponding decrease in the summer.

E. Rost favored the idea of more uniform forces as a means of obtaining a better class of men, his opinion being endorsed by a number of other speakers. E. T. Howson, *Railway Engineering and Maintenance*, pointed to the concerted efforts being made to stabilize forces by efforts to secure more permanent employment and cited the marked decrease in the fluctuation of railroad forces, which is now less than half of what it used to be. He felt that the recommendations of the committee would be of considerable help to the roadmasters in obtaining more uniform forces. The report was adopted

The Roadmasters' Opportunity For a Broad Constructive Service

By L. W. Baldwin
President, Missouri Pacific

THERE IS no more important work in the business of producing railroad transportation than that which is performed by you men and under your direction and supervision. I know whereof I speak because at one time I was myself a roadmaster and I am entirely familiar with your problems and your worries. You men have in your hands an opportunity for service of a big, broad, constructive kind, part of which is incidental to and a necessary part of your daily work and part of which might be considered entirely aside from your routine duties, but which to my way of thinking is and should be regarded as a part of the work and duties of every railway employee, and especially every railway officer. I am referring to the opportunity which all of you have to help in thousands of incidental ways to make your respective railroads better properties; to instill in your associates and the employees whose work you supervise a spirit of greater loyalty to their properties, based on a better understanding of the fundamental things in the transportation industry. But you have an even greater opportunity, as I see it, to inform yourselves and in turn to inform your friends and the public generally about the railroad business so that the public may understand better and appreciate more easily the questions with which we are confronted.

This means, naturally, that each of you must study a great many things besides the business of maintaining track, laying rail and similar matters. It means that you must familiarize yourself with the problems of the management. You must learn more about the cost of producing transportation and the many and various things that enter into that cost. It means that you should keep yourself familiarized, not only with the costs of those things which you handle and which enter into the production of railroad service, such as ballast and steel, ties and labor, but also with the cost of fuel and other supplies and equipment and facilities generally.

While the question of railroad rates is an intricate one, I believe every railroad officer should study them so much as possible and at least be familiar with the principles involved in rate making. Information of this kind is easily obtainable. The railway publications to which most of you subscribe, or copies of which you can easily obtain, are regular text books for this kind of information, and the reports which you make daily and use and other reports which are made and used on your respective properties and which are available for your study will supply almost unlimited information on these questions.

Most railroads have more or less well developed systems for distributing information of a miscellaneous character, through company publications, bulletins and other methods.

One of the very best ways I know of to obtain information of this kind is by attending conventions such as this where you are enabled to exchange information and ideas and collect a fund of information that otherwise would be a great deal more difficult to obtain. I think these conventions are well worth while if they serve no other purpose than to permit railroad men to get together occasionally and get acquainted with each other. But they do serve a much greater purpose.

I know that all of you are familiar, in a general way at least, with the great progress that has been made by the railroads of the United States in the last five years. Each of you has had a most important part in that progress. I know that you are familiar also in a general way with many of the problems and handicaps that have made the achievements of the last five years

more difficult and more noteworthy. You all recall the tremendous agitation that has only recently died away which had for its purpose government ownership of railroads.

I do not believe it is possible under any form of political control, and that is what we would be confronted with in this country, for the railroads to be so efficiently or economically managed as they are under our present system. I do not believe it would be possible to operate our railroads under a form of political control without them suffering terribly from the evils of political patronage and the errors of political mis-management.

However, I do not desire to discuss at any great length the question of government ownership. The railroads are now confronted with a much greater and graver problem. That is the question of growth and expansion and development, in order to meet the ever-growing needs of our country. The increasing population of the United States, the increasing volume of traffic that results from year to year, the trend toward centralization of production, the increasing acreage and production of agricultural products—all of these things are resulting in a constantly increasing volume of traffic that must be handled by the railroads. The economic welfare of the entire country is absolutely dependent upon the ability of the railroads to furnish adequate and dependable and satisfactory transportation. When, for any reason, the railroads are unable to transport the commerce of the nation promptly and economically, every line of business in the country must suffer in consequence. With prompt and adequate transportation, business is speeded up in all lines, money is more plentiful, labor in all lines is more profitably employed and prosperity rests upon the country.

In order to produce and provide the kind of transportation the country must have, the railroads must be able to obtain large quantities of capital for the constant improvement of transportation machinery. New and improved equipment—heavier and more powerful locomotives, better freight cars and equipment of all kinds—must be provided in increasing quantities, roadbeds must be improved and facilities of all kinds must keep pace with the progress.

All these things are possible only so long as the railroads are a "going concern." If and when the railroads receive a sufficient volume of traffic and are able to handle it with the economy and efficiency that is necessary at a fair rate for the service performed, the railroads can go forward. It all hinges in the final analysis upon a fair rate.

It has been more or less popular in this country for many years to blame the railroads and railroad rates for almost all the economic ills with which the country has been confronted. As a matter of fact that is far from the truth. Railroad transportation in the United States is, I believe, the cheapest thing in the world. When we remember that even in the last few years, in the face of all the difficulties and handicaps with which the railroad managements have been confronted, with the cost of materials, supplies and labor averaging more than 100 per cent above pre-war levels and railroad rates averaging only about 50 per cent above pre-war levels, the achievements of the railroads are truly remarkable.

They are all the more remarkable when judged by other standards. It is an accepted fact that the standard of living in the United States is from two to six times higher than in any other civilized country and it is an accepted fact that wages and incomes of the average citizen are proportionately higher. These things enter into the cost of producing railroad transportation service. In the face of this fact, countries with much lower standards of living and with lower wage rates are paying tremendously higher rates for railroad transportation.

In the United States, for instance, the average rate for hauling a ton of freight one mile is only slightly more than 1 cent—1.11 cent to be exact. In Great Britain the rate per ton mile is 3½ cents; in France the rate per ton mile on the privately owned lines is 4 cents and on the government owned lines is 4.8 cents. In Switzerland the rate is 6 1-3 cents; in Norway it is 5 cents; in Sweden it is 4½ cents; in Denmark it is 6½ cents, and in New South Wales it is 2½ cents, while in South Australia it is 3 cents. In other words, the cost of transportation service in other countries is 2½ to 6½ times as much as the same service costs in the United States.

As I said a moment ago, the achievements of the railroads in the last five years have been made in the face of the fact that almost everything that enters into the cost of producing railroad transportation service is more than 100 per cent above the pre-war level while the rates received by the carriers for the service performed are only about 50 per cent above pre-war levels. These figures are for the railways of the United States as a whole. The western railways are not nearly so fortunate. While the western lines constitute nearly 60 per cent of the total railway mileage of the United States, they handle only about 40 per cent of the tonnage, and a large portion of the tonnage handled by the western lines is either commodities which take a very low rate or is commodities which require special equipment and special handling, such as agricultural products and especially perishables and livestock.

It is for these reasons that the western lines recently applied to the Interstate Commerce Commission for a 5 per cent increase in rates. Even that increase, if granted, will not enable the western lines to earn the meager 5¾ per cent which Congress and the Interstate Commerce Commission has said would be a fair rate of return on the capital invested for the production of the service. Whether or not the increase is granted there is a lot of misunderstanding and I think every railroad officer—and each of you can be a tremendous help—should inform himself of these facts and help to inform the public so that the public may understand the necessity for the railroads receiving a living wage.

These things should be brought home to every business man and every farmer and every citizen of the country, and that task can best be accomplished by men such as you thoroughly informing yourselves and in turn informing your friends and neighbors and your fellow citizens.

The public is, I believe, fast coming to have a better appreciation of railroad men and the railroad business, and that is right and proper. There is no more noble or worth-while calling in the world, there is no service more vitally necessary, and there are no finer citizens anywhere than are produced in the railroad business. I am proud of my profession and every railroad man should be proud of his calling. The public should be taught to realize that the 2,000,000 wage earners on our American railroads are good American citizens—in fact about 10 per cent of our total population—and the public should realize that when the railroads are hurt, the 2,000,000 railroad employees are hurt, and the 1,000,000 citizens in allied industries which are dependent upon the railroads for their very existence

are hurt, and the public should realize that it is not possible to injure or endanger the welfare and prosperity of 15 per cent of our total population without the entire country suffering.

I believe we are on the eve of an era of sustained prosperity. I believe our industrial development in this country and the agricultural development are going to continue. I believe that development will require more and better transportation and I believe the American people will—when they thoroughly understand the question—accord their railroads a fair deal. I believe absolutely in the soundness of our American institutions. I believe in the doctrine of equal rights and property rights which have made this country great. I believe the opportunity for service for each of us will grow greater as time passes, and I know that the railroad fraternity will measure up to the opportunity.

Weeding of Tracks---Methods and Costs

THE TOLERANCE of weeds in tracks has a far reaching effect in the deterioration of ties, the fouling of ballast and the producing of irregular surface due to the moisture held in the ballast by the weeds. Conditions of this kind contribute to the damage of the entire track structure which is reflected even in the rails and fastenings. Furthermore, after a certain stage, the vegetation must be removed to at least some extent or operation is out of the question, while it detracts from the appearance of the railroad. Therefore, at least all main tracks should be kept free of vegetation to the toe of the ballast section.

The reasonable extension of a grass line, to include from 12 to 18 in. of subgrade or berm beyond the toe of ballast, is of great value from the maintenance standpoint, as this effects a corresponding improvement in drainage and the drying of ballast, roadbed, and track to an extent that fully justifies the added expense. We believe that on main line tracks it is false economy to narrow the grass line to a point that will bring it into the ballast section, as is being practiced on some lines for the sake of economy. Experience has proved that this narrowing interferes with drainage and calls for expenditures in repairing the damage done, which exceeds several fold the expense of keeping the grass line out. On light branch lines with soil ballast, it is generally considered sufficient to keep vegetation down enough so that a locomotive will not loose footing and cause an actual tieup. In connection with the removal of track vegetation it is also necessary to mow a swath of grass and weeds from the grass line when they have reached a stage where the identity of the grass line is open to question. This should be done at least once before the general cutting of the right-of-way.

It is the aim of this committee to determine the best method of exterminating track weeds from the standpoint of economy and for the purpose of avoiding interfering with regular maintenance forces at a season when trackmen should be engaged in other important duties. To this end, the various methods of weeding track, including the old time hand practice, burning, steaming and chemicalization, are discussed in the following paragraphs.

Hand Methods

This committee has accumulated some data on the cost of hand weeding of tracks in the various ballasts. The reports show that in gravel, cinder and earth, the average expenditure is $130 per mile per season; with the lowest cost reported as $80 and highest $225.

In rock, stone and slag ballast 18-ft. wide the average cost of two to four cleanings with shovels and by hand pulling is $155, with the minimum $92 and the maximum $276. These figures are made on the basis of 40 cents per hour for labor and represent the cost of making from one to three cuttings.

The hand mowing of a swath from the grass line twice per season will require about four day's labor per mile or $16, while if motor car power mowers are used the same results may be obtained at a cost of about $2.50 per mile. Incidentally it is found that the cost of hand weeding is lowest in the northwest and runs heavy rather generally throughout other localities.

This hand arrangement necessitates the general stirring up of ballast and produces dirty track, especially where the ballast is more or less light. Unless the weeds and grass that have been cut are thoroughly raked up and disposed of, they will, under favorable weather conditions, commence to sprout and grow almost immediately so that the ordinary ballast is seldom entirely free from a growth of vegetation at some stage in the growing season. Of course this does not apply to the heavier ballasts but the expense of maintaining a neat appearance by hand methods runs up correspondingly.

Burning Methods

For many years a number of railways have operated weed burners of various types on the branch lines. Within the last few years improvements have been made in the design of these outfits that have reduced the amount of oil consumed in burning about one-half; consequently the development of the oil burner is encouraging.

In general the original type of locomotive-propelled burner operates at a cost of about $13 per mile per burning for a width of about ten feet, including train, fuel costs, etc., the two and three burnings necessary per season cost from $26 to $39. These outfits use about 80 gallons of crude oil per mile per burning, the oil being pumped from a special tank on the car to the track burners where it is volatilized by air pressure that is also forced by steam pumps.

The Illinois Central made an improvement in its burners of the locomotive-propelled type last year by changing the principle of the oil delivery so that it is atomized by superheated steam instead of air which reduced the crude oil used to about one-half, or 40 gallons per mile per burning. The waste of unburned oil has been overcome as it is now entirely consumed by the burner.

The further main advantages are that the burners may be ignited and cut out in an instant, thus dispensing with the delay of the former type, also the intensity of the burner flame is under full control of the operator. The burner plates take in a 14-ft. width and burn a total width of about 16-ft. top section, or five feet wider than the air-volatilized type. The 1924 record of this outfit shows a cost of $6.20 per mile for burning 1286 miles or a cost of one-half compared with the old type burner mentioned above. It is understood that further improvements are now being made to reduce the costs still lower.

A new so-called portable weed burner is also in use this season on the Great Northern, the Northern Pa-

cific and the Soo Line where it is giving very satisfactory service. This machine is built in two types, one of three units and the other a single unit. Both are propelled by a 10 or 12 hp. gas engine and vaporize the oil by a high speed blower. Various low grade oils are used. The oil capacity ranges from 575 to 1000 gal.; about 45 gal. of oil is used per mile.

The performance of a portable burner on a 136 mile branch line on the Soo Line during the latter part of June, 1925, in a 14-day test when the line was burned double, the vegetation being scorched while going in one direction and burned upon its return, is as follows:

6387 gal. distillate oil at $.063	$402.38
124 gal. gasoline at $.10	12.40
Operator 140 hours Operator helper 140 hours	139.65
	$554.43
Total miles burned, including 6 miles siding	142.
Cost per mile	$3.90
Miles burned per day	10
Gallons distillate per mile	45

There has been some minor trouble with one of the portable type burners burning out the fire brick this year, but arrangements will be perfected to overcome this as it passes from the experimental stage.

Steaming Method

The steaming method consists of a system of pipes arranged on a flat car, used with a superheated locomotive, making it possible to apply superheated steam to the vegetation at a temperature of about 500 deg. The cost of equipment for this operation is about $2500. The construction of the burner and side wings is such that a standard width of ballast section may be covered. The burner aprons are hung so that they come close to the ballast. In general the cost per mile of one burning ranges from $10 to $16, covering approximately 10 to 14 miles per day. While operating under ordinary conditions, a speed of 2½ miles per hour is made although in rainy weather the speed is reduced to 1½ miles per hour.

A good locomotive is a necessity with this method as a great deal of water is consumed and the providing of steam is one of the main requirements. Reports show that it is necessary to have as many as six tank cars in the outfit to provide water for the steaming between watering stations. A typical statement of the cost of this operation may be taken from the following figures of the performance of a machine on the Santa Fe where 136 miles was steamed in 1922.

Wages of train and engine crew	$580.56
Engine watchman	34.02
Wages water service man	14.80
Wages of laborers operating machine	116.30
Expenses of laborers	31.00
Work train expense	304.48
Engine rental 10 days at $25.00	250.00
Rental of caboose 10 days at $1.00	10.00
Royalty for use of machine $1.00 per mile	136.00
Total	$1,477.16

or $10.86 per mile, one burning. At least three steamings are required per season.

It is said that best results may be obtained by running the machine when the vegetation is tender and repeating the operation to burn the grasses and weeds before they reach the stage of strength.

Extermination by Chemicals

The extermination of track weeds by chemicals has been practiced more or less for 20 years, but until recently the cost of the ingredients has limited the operation to the heavily ballasted high class lines. With recent reduction in prices, it would seem that there is a larger field for chemicalization. Ordinarily the arsenious content of this solution is about four pounds per gallon and it is usually applied under the supervision of the chemical company in a solution of from 1 gal. of the weed killer in 4 gal. of water to 1 in 20. It is conveyed to the track in a train consisting of a number of tank cars, each discharging into a common main. The liquid is forced forward through this main to a spray assembled on the front of a flat car, by air pressure from the locomotive in the rear of the train. The spraying head on the flat car is equipped with a feed pipe, mixing devices and a regulating valve, so arranged that the solution is adequately delivered through each of the spray nozzles. The nozzles are collectively and individually under the control of the operator. They are so arranged that the center of track between the rails, the ends of ties or the top shoulder and the section from the top shoulder to the ballast edge or grass line can be treated at the same time or independently.

Meters on the operating car measure the chemical consumed for each load and also the diluted solution which is sprayed on the track. The tank cars in which the solution is mixed are equipped with a mixing device in the form of a one-inch pipe laid the length of the tank car at the bottom and perforated with 1/32-in. holes, 12 in. apart, through which air from the train line is forced to agitate the contents.

It is understood that the price of the chemical in general is now considerably lower than it was last year so that the cost of the concentrated killer is now around 30 cents per gallon, as compared with approximately 50 cents last year. The supplying companies claim that under ordinary conditions with a reasonably heavy growth of vegetation, $40 per mile is a fair estimate of the cost of treating a width of about 18 ft. including the cost of train service, etc. In determining the amount of concentrated solution per mile one may figure on from eight to ten gallons for each foot width of track one mile long for the initial or first treatment, although there is a wide range in application, the extremes being as little as 25 gal. and as high as 125 gal. of the undiluted or concentrated chemical, depending upon the density of the weed growth and the resistance of the particular types of vegetation.

Many roads have been opposed to the use of chemicals, owing to the solution being poisonous to stock. One of the chemical companies claims that a non-poisonous solution has been perfected that retains every quality necessary to kill weeds. Where the poisonous solution is used the precaution of keeping cattle away for a period of about four days after the application, lessons the liability of claims through the loss of livestock. Most of the chemical companies assume responsibility for livestock claims under a standard agreement.

In treatment in the second and subsequent years, the quantity of solution applied to track may be reduced materially. Equal or better results being obtained the second year with between 20 and 30 per cent less solution.

The initial idea in applying the weed killer was to saturate the ground through a sprinkling method in an attempt to reach the roots but this practice has been superceded by a system whereby a stronger solution is used which exterminates the vegetation by the absorption of the destructive chemical through the tops of the weeds and grasses to the roots.

Various members of the committee report that the

Roadmasters' Party on an Inspection of the Kansas City Terminal

cost of chemicalization ranges from $30 to $90 per mile the last few years where only one treatment was given per season and where in most cases the width of treatment was about 12 ft. or to a point a short distance beyond the ends of ties. There seems to be no particular differences in the cost per mile of chemical treatment in the various ballasts, including stone, gravel, dirt and cinders.

An itemized statement of the cost, etc., of the chemical method of extermination on 458 miles of Sante Fe lines last year, giving an average cost of $85.85 per mile for one application, is as follows:

Total Cost of Applying Chemicals

	Miles Treated	Cost of Chemical Including Freight	Work Train	Extra Labor	Water	Grand Total	Aver. Cost Per Mile	Aver. No. of Gal. Applied
Western Lines—								
Retreatment	34.2	$ 2,182.78	$126.55	$ 20.61	$ 4.62	$ 2,334.56	$68.26	*
Treatment	157.2	13,244.84	475.29	71.03	42.29	14,083.45	89.59	*
Coast Lines—								
Los Angeles	25.5	1,692.99	136.26	38.56	8.67	1,876.48	73.58	170
Valley	56.4	4,653.63	403.96	74.35	25.93	5,157.87	91.45	206
Gulf Lines—								
Southern	93.7	7,665.43	332.33	246 22	15.11	8,323.09	87.86	145
Northern	91.8	6,716.38	322.03	311.87	13.22	7,611.50	82.91	131
Total	458.8	$36,156.05	$1,796.42	$762.64	$109.84	$39,386.95	$85.85	.....

*Varying.
Chemical costs—$0.56½ per gal., spring delivery; $0.40 per gal., fall delivery.

About the latter part of July the C., M. & St. P. began a rather extensive program of exterminating weeds by a chemical mixture diluted with four parts of water. During application the train moves at a rate of ten miles per hour, about 300 gal. of the diluted solution being sprayed per mile. An authoritative statement is not available at the time of writing this report but it is estimated that the entire results will be obtained in one application at a cost of $25 per mile including all charges.

Results are being obtained in ordinary gravel and cinder ballast by weed cutters driven by a 10 to 15 hp. engine, mounted on a car from which cutting blades are forced through the ballast shoulder beyond the ends of the ties. From data available, we find that the device is operated by from two to three men over about eight miles of track per day and will do the work of a number of men.

Conclusions

The conclusions of this committee are that the most economical and effective methods of exterminating weeds and grasses are by the weed burners and by chemicalization in the territories adapted for each procedure.

Various types of weed burners are necessary to meet the problems on branch line and even on main line first class trackage. They are recommended for main line use with the necessary touching up by hand or machine to perfect the grass line and to furnish the width necessary beyond the reach of the burner; however it is expected that the width of burning hood may be increased to burn to about 2½ ft. beyond the ties instead of 1 ft. or less as at the present time.

On first class main lines with any kind of ballast, but especially in stone and rock or similar ballast, there is no question but that the use of chemicals at this year's quotation and with further cuts in price, provides the solution for the problem from every viewpoint. Compare the cost of hand weeding as shown in the forepart of this report and it is evident that the chemical is actually the cheapest in the initial application without any regard to the cumulative effect or more or less permanent killing of vegetation. Furthermore since from 50 to 100 miles of track may be treated per day, the work is carried on with little interference to the regular revenue traffic.

Committee: J. B. Kelly, general roadmaster, M. St. P. & S. S. M., chairman; R. L. Longshore, division engineer,

Wabash; E. E. Crowley, roadmaster, D. & H.; J. A. Rutledge, roadmaster, S. P.; J. Daugherty, division roadmaster, St. L.-S. F.; M. V. Holmes, roadmaster, A. T. & S. F.; W. B. McVan, roadmaster, A. C. & Y.; E. P. Hawkins, division engineer, M. P.; W. O. Rutherford, track supervisor, C. G. W.; J. J. Navin, supervisor, Penna.; J. E. Sewell; A. Larson, roadmaster, N. P.; A. W. Wehner, roadmaster, S. P., and F. H. Hanson, division roadmaster, G. N.

Discussion

A number of speakers called attention to the necessity for avoiding the sprinkling of the chemical solution at the crossings of both private and public roadways as a precaution against killing stock. A. M. Clough, N. Y. C., reported that he was obtaining good results with a ballast harrow attached to a flat car which was effective in destroying the weeds beyond the ends of the ties and causing the cinders and other foreign matter in the ballast to settle to a depth below the surface and discourage the growth of weeds. James Sweeney, C. & E. I., said that he had obtained similar results in the space between tracks by the use of a horse cultivator. A number of the members recounted their experience with the use of chemicals in killing weeds and the discussion throughout was generally favorable to this practice not only because of its effectiveness but as a means of conserving labor.

You Are a Part of the Great Game of Railroading

By W. B. Storey
President, Atchison, Topeka & Santa Fe

FOR THE PAST forty years I have been associated with roadmasters as fellow workers in this big Railroad Game. I said big Railroad Game and it is a big game. It is the biggest thing in America today. It employs more men and buys more supplies than any other single business, and on it the entire life and prosperity of the country depends. It is a big game and I am glad to be in it and part of it, and I know that you roadmasters who are such a vital part of the game, are proud to be in it. But the public knows little of you. It thinks of the engineer driving the huge locomotive through the night, but it knows nothing of the roadmaster who has made the track safe for that engine. It thinks of the train dispatcher weighted with the responsibility of keeping trains from running into each other, but it does not know of the roadmaster who must keep the track clear of slides. The public does not know of the roadmaster who, in washout, in snow blockade, in disaster of any kind, is always on hand day or night doing his part to again get the road to running. I wish, therefore, to pay my tribute to the roadmaster and to tell him how valuable a part of the organization I consider him.

Why Do We Attend Conventions?

Why are we here and why do we hold these conventions? We are here to add to our knowledge of track and to make ourselves better men for the work we have to do. Many railroads and many officers of railroads in their efforts to keep down expense, think that such associations as yours should be eliminated on account of the time lost and the cost to them, that the amount of good that comes from them does not warrant the money they cost. Others of us take a somewhat different view. We believe that anything that brings men together so that they may compare their experiences is worth while. No one man knows it all. Human knowledge today is vastly greater than it was one hundred years ago, and it is made up of not what one man has found out, but by the accumulated knowledge of many thousands of men. Then again we learn by mistakes—either of our own or of others. The opportunity of meeting other men in the same field of endeavor, of listening to the experiences of others, of learning by the mistakes of others, is profitable to us all, and such meetings as this are profitable because you have a chance to learn what the other man thinks. In addition there is the chance for a let-up in the daily grind which we all go through, and this is a benefit to each of us.

As a whole, therefore, I feel that an association like this is a good thing—not only for the individual roadmaster but for his railroad. We cannot always measure in money the advantages of everything we do, but I believe it to be a paying thing for a railroad to have its roadmasters come to these meetings.

To make it profitable, however, each man must take something away—something of profit to himself and hence for the good of his road. You may not remember all the papers that are read or the addresses that are made, but you can pick up something that you can take home with you. There are the exhibits of the railway supply people which are always worth while. Study them and see if they have better devices than you have on your home road. You may not be able to make your superintendent or your resident engineer adopt them, but have an opinion and some day you may find it useful. Just one word to the younger men here. Do not be afraid to ask questions and to discuss the papers and reports that come before you. You may think you will make a chump of yourself, but you will find it out just as soon as the other fellows and you will not be a chump the next time you get up. And further, if you do not talk in the meetings, talk outside and listen to the other men talk.

I now propose to go over the general railroad situation as I see it today. Some of you are so busy trying to keep your track up in shape with less men than you know are necessary that you may not have thought of the other large problems that come up to the administrators of railroads, and it seemed to me that it might be profitable to take a larger view of the situation as it stands today and see what, if anything, we roadmasters can do to help.

Railroads Deal With Three Classes of People

In the first place, the railroad has to deal with three classes of people—those who have their money invested in the roads, those who use the roads, and those who work for the roads, or giving these several classes names—investors, shippers, and employees. These three classes all want different things. The investor wants interest on the money he has put into the concern; the shipper wants the freight rates as low as possible, and the employee wants as high wages as possible. If the investor cannot get interest on his money he refuses to put up any more capital and then necessary improvements cannot be made, enlargments that are needed to keep up with the growth of the business of the road cannot be authorized, and you men of the track know what that means. The shipper, on the other hand, wants lower rates and is constantly

At the Plant of the National Lumber & Creosoting Company

striving for them. If the farmer is hard up due to low prices for his crops he asks for lower rates to help him out of his difficulties. The third class—the employee —wants higher wages and if he does not get them, has a weapon in the strike.

It is the duty of the railroad company to keep all these three forces, pulling in different directions, in equilibrium, and in their efforts to do this each party involved is apt to think he gets the worst of it. The shippers, being more numerous than the other classes, started to take a hand in the matter by insisting on governmental regulation, and thus came the Interstate Commerce Commission, followed by commissions in the various states. The duty of these various commissions, however, was solely to protect the shipper from the railroads, and as a consequence the rates gradually decreased and the so-called regulation became tighter, until finally the investors began to suffer because the roads could not pay interest. The investor had no way of forcing his rights, but he did have the privilege of refusing to put any more money into the roads. This in turn prevented the necessary additions and betterments so that as the business of the country grew, the railroads did not keep up with that growth.

When this country went into the war a tremendous burden was thrown on the road which they could not handle, due to the regulations that had been established, and the Government took over the roads. You all know what happened then. We had to win the war and we won it, but the roads were left in sad condition. There was one excellent result; the experiment convinced the American public that they did not want government ownership and Congress took up the matter and gave it very thorough study, and as a result passed the present law under which we work, known as the Transportation Act of 1920.

This Act tried to recognize the rights of all the three kinds of people I have already described. To help the investor it instructed the Interstate Commerce Commission to so fix rates that a fair return would be given to the money invested in the roads. In other words, the Interstate Commerce Commission was not only to protect the people from the railroads, but it was to protect the roads from the people. To take care of the employees it provided the Labor Board to hear all disputes that might arise and that could not be settled in any other way. Thus having taken care of the investor, the shipper, and the employee, they gave the roads back to their owners. You might think that having taken care of these three classes that all our troubles were over and the roads would almost run themselves. We have now been working under that law for over five years and it may interest you to take a look back and see how it has worked.

The Interstate Commerce Commission has tried to do what was intended. It increased the rates, as it thought, sufficient to give a return on the investments, but their calculations were based on a certain volume of business. The business of the country slumped badly and the roads did not earn the percentage necessary, but they did much better than they had been doing. Then we all tried to reduce our expenses in various ways and the result is that each year we have been doing better. The rates are still too low, but it is a very difficult thing to increase them because of the effect on business.

Now as to the shipper: He has tried to get reductions in his rates and in some cases where they were manifestly out of line he has succeeded, but, on the whole, the Interstate Commerce Commission has recognized that if it cuts the revenues of the roads too greatly it will stop the development of the roads. As to the employees: The Labor Board has held many investigations and made many decisions. It has not, however, prevented strikes—as for instance the shopmen's strike. But, on the whole, it has accomplished good. All organizations today hesitate to refuse to follow the decisions of the Labor Board, because those decisions tell the public what an impartial board finds as to the facts in the case. Taken as a whole, therefore, I feel that the Transportation Act has been a success and that it should not be changed until it has had a longer trial.

How does this interest you as a roadmaster? Because changes are proposed. We are in constant danger from new laws and we want you to know the dangers we face and to understand our problems. Laws are being introduced continually to try to make changes. To illustrate—the Interstate Commerce Commission held a long investigation as to grain rates and decided that it could not lower them and still carry out the intent of the law as it now stands. A bill is before Congress to cut rates on all agricultural products one-third. Another bill is to do away with the Labor Board and substitute a most vicious meas-

ure that would throw the entire control of our employees into the hands of the unions.

What we want is to be let alone. We do not need any more legislation. We now have regulation and lots of it and we prefer to learn to work under that regulation rather than to have to adapt ourselves to something new. So when you hear the question of regulation discussed, tell them all we want is to be let alone. You, as roadmasters, come closer to the people than we in the administration of the roads—explain to the people that we want to find out if we can succeed under the present plan.

That is my message to you—help us outside of your track problems, help us with the public. We need friends and you can make friends for us. Realize that you are part of this great game and be part of it

Raising the Standard of Maintenance Forces

By Col. F. W. Green
Vice-President, Saint Louis South Western, St. Louis, Mo.

YOU HAVE a record of accomplishment in the past of which you may well be proud and which promises continued satisfactory development in the future. I hope the day is not far distant when every roadmaster in the United States is an active member of your association. I say "active" because if he is active he will give and receive benefit from the affiliation, whereas if he is inactive, his membership will do the association little good and himself still less.

When men of similar pursuits meet to consider and discuss their respective problems, an exchange of ideas results which is mutually beneficial. On the other hand, if a man is possessed of infinite wisdom and yet fails to communicate any of it to his fellowmen, he contributes very little to the evolution of humanity. The parable of the talents shows how the man with the one talent, by the effective use of it, obtained greater rewards than the man who had ten. There is an ethical obligation resting upon all of us who desire to play a manly part in the development of civilization to broadcast new ideas and methods, not with a view to self-aggrandizement, but rather of submittiing them to the constructive criticism of the world to the end that, if they are good the world may benefit thereby, and that, if they are not good we may benefit by constructive criticism. Where would the world be today if Watts had kept to himself the idea of the steam engine, Edison the idea of the electric light, and Ford the "flivver"?

Good Men the Primary Requirement

After hearing so much today about how the work of the maintenance of way department can be improved by the use of better material on the one hand and better tools on the other, I am reminded of the story of the three gentlemen of Warsaw who had adjoining stores. Upon coming down to work one morning, the man who owned the middle store found that his competitor on the one hand had during the night erected a large sign reading, "fire sale," while at the same time his competitor at the other side had put up a sign reading, "bankrupt sale." With the resourcefulness so characteristic of his race, he lost no time in putting a sign over his own store, between the other two and larger than either of them, reading "MAIN ENTRANCE." I hope that I can persuade you to believe that the subject I am to speak about is of greater fundamental importance than that of either improved materials on the one hand or improved tools on the other. I therefore proceed to erect my sign between these two, designating the "main entrance" as good men. By good men I include both the supervisory and the working forces.

The first requisite is good supervision; in this I include the supervisory forces ranging from the president to the foremen. Without good supervision the employment and performance of the working forces will not be efficient as a whole. Now and then efficient laborers will be found, but without the stimulus of competent and efficient supervision, they will not long continue efficient.

Successful leadership requires the possession of many traits and in the selection of leaders from section foremen up, the officer charged with the duty of making the selection should keep these in mind. It goes without saying that no man possesses all of them in the exact proportions which the ideal man should have, but in any case the man selected should possess them in sufficient degree to enable him adequately to discharge the responsibilities of the place.

At the head of the list I would place *common sense*, as a man without common sense is worthless as a leader. Next I should place *initiative*, as a man without initiative is as useless as a watch with a broken main spring. Next comes *resourcefulness*. Without it a leader is likely to suffer the embarrassment of having to confess in the presence of his men that he does not know what to do or how to do it and loses their respect for his leadership.

Next comes *adaptability*, which, being interpreted, means that the leader can readily adapt himself to any situation in which he finds himself. He can get along with people, whether or not they are his particular kind of people, and he can do any kind of work whether it is his particular specialty or otherwise. Next comes *moral courage*, which enables him to say the thing that ought to be said at the time and place where it should be said, both to his subordinates and his superiors.

Next comes *decision* and without it all of the other qualities are as naught. A leader should be able to size up a situation and reach his decision quickly, and having reached it to stick to it. A man who vacillates or who continually changes his mind and his methods can never be a successful leader. You can never put your hand on him. He is like the Irishman's flea.

Next, he must be *competent*. He must not only know what to do and how to do it, but in addition must be able to show his subordinates how to do it in the best way. Hardly anything loses the respect of the subordinates for the leader more quickly than his lack of competence. Competence includes the ability to know what men can do and then to make them do it.

Next comes *fairness*. A successful leader must always be able to see both sides of a question. He must consider impartially and decide justly any question arising which requires his decision. He must not take unfair advantage of his subordinates on the one hand or of the company's interest on the other, and he must be as prompt in praise as in punishment, as well as frankly to acknowledge any error he may have made. Next, he must be a *real leader*, which means that he will lead his forces rather than drive them. We are living today in an age of mutual cooperation and helpfulness and the successful leader of today is

the one who can inspire and maintain a spirit of helpful cooperation, rather than a resentful spirit of sullen obedience. Next comes *enthusiasm.* A man in any work who aspires to succeed must love that work. He can never accomplish the best results unless he shows an eager enthusiasm and can impart it to his subordinates.

Next comes *tact,* which is an intuitive appreciation of what is proper. A leader who is inconsiderate or who shows a lack of sympathy where sympathy is indicated, is justly described as a brute. On the other hand, a tactful leader establishes and maintains cordial relations with everybody, even his enemy. He shows an interest in the health of his men and their families, lends a sympathetic ear to their troubles, kisses their babies and pets their dogs. Next comes *imagination,* which means the ability to picture in his mind's eye how the work that he is doing will look when it is done. The ability to visualize the completed job is of great value to the leader charged with the duty of its execution. It enables him to plan his work more intelligently and carry it forward without interruption.

He should be *alert* and *observant.* It has been said that the most useless thing in the world is a glass eye at a keyhole. If this be true, then a close second is the eye that sees not and the ear that hears not. Alertness is almost a sixth sense in that some men instinctively possess it in high degree, while in others it must be assiduously cultivated and even then is sometimes developed only to a rudimentary state. Our ideal leader will also possess the necessary analytical and constructive ability to enable him to function efficiently. I mean by this that he will know how to plan as well as how to push. Dr. Stanley Krebs says that a plan without push is theory; push without plan is fussiness; while a plan with push is successful accomplishment. Expressed in more practical terms, this means that the leader, when given a job to execute, must know, (*1*) what is to be done; (*2*) where it is to be done; (*3*) when it is to be started and completed; (*4*) what men, tools and material are on hand for its accomplishment and what must be obtained to complete it; (*5*) how it can best be done; and, (*6*) why this is the best way of doing it. I would like to emphasize the importance of the leader knowing why he executes his mission in the way he does. There is a very important relation existing between the how and the why of a job. If it is attempted by a man who merely imitates the method by which it has been accomplished by others and without any understanding of the reasons for so doing it, there is very little doubt but that it will be poorly executed if at all, as compared with the man who knows how to do it and why he does it that way.

There are no doubt other essential qualifications that our ideal leader should possess, for example: energy, resolution, firmness, as well as integrity of character and a willingness to take orders as well as to give them and to cooperate loyally with all interested parties in the successful accomplishment of the job at hand; but, of all of these, I would emphasize the quality of perseverance—the "never-say-die" spirit. Fighting determination and intrepid resolution seldom fail, while perfunctory attempt and chicken-hearted effort are invariably the accoutrements of the man who is forever complaining of how badly the world treats him.

I would also put special emphasis upon that quality of mind which never admits that things which have not been done before cannot be done now. To me, the most distressing word in the English language is the word *"CAN'T."* It is an acceptance in advance of judgment by willful default and is one of the most outstanding evidences of the inferiority complex. A man who admits to himself or to others that he "can't" do something which has to be done, is admitting his incompetence, while the man who claims that the thing which he can't do cannot be done by others soothes his conscience with the hope that they are as worthless as himself.

The Forces to Be Supervised

Having progressed thus far in raising the standard of maintenance forces by improving the quality of the supervision as above proposed, we now turn to the other side of the subject—the forces to be supervised. I do not believe it takes any extended argument to convince a group of roadmasters that if the supervision is 100 per cent there will be very little difficulty in raising the standard of the laboring forces to a much higher degree of perfection than exists at present. Competent and efficient supervision will be able to discriminate between good and bad. It will not permit a hat to be called a man, or vice versa. It will not employ a club-footed man for a foot racer, a hairlip man for an opera singer, a one-armed man for a fiddler or a blind man for an inspector.

In the employment of men, competent and efficient supervision will give preference to those who have the ability, mental and physical, to do the work for which employed, as well as showing promise for greater responsibilities in the future. If the laborer is given to understand that promotion can be earned by diligent and effective performance, he has something to work up to. Without such hope, he is likely to be indifferent to his work and inclined to do only enough to avoid being dismissed.

It has been my observation that willing and efficient men are found where three conditions exist, namely (*1*) a good foreman; (*2*) a good prospect for promotion; and (*3*) continuous work at standard rates of pay. There are good reasons for this attitude of mind on the part of laborers. They know from bitter experience that when they work for a good foreman they will be well treated, not in the sense of being permitted to loaf on the job, but rather because a competent foreman knows what men can and should do and requires them to do it. He knows the various tricks of the trade by which the back-breaking kind of work can be reduced to a minimum and the strength and safety of the gang conserved, so that they can accomplish more with less effort than a gang led by a poor foreman. Moreover ,they know that their own chances of advancement when learning how to do the work under a master is much better and their sense of self-interest and ambition for promotion create in them a desire to work for a good foreman rather than a poor one. Notwithstanding all that has been said about all men being equal, the fact remains that experience has abundantly proven that all good laborers aspire to some recognition of their worth. We cannot blink the fact that the title of "boss" and a few cents more per hour changes many a democrat into an aristocrat.

The question of continuous employment is fundamental in its importance. I do not know of anything, even incompetent supervision, which will ruin the morale of an organization more quickly than repeated alternations of increasing and decreasing working forces. A grave responsibility rests upon the executives of our railroads so far as possible to keep regular forces continuously employed throughout the year if the greatest efficiency is to be expected from such forces. The constant fear of lay-off is demoralizing. Laborers usually live from week to week or day to day and an interruption in their earnings means privation for themselves and their families. Good men gravitate to regular jobs where lay-offs do not occur and, consequently, the quality of the men to be found on any job may be expected to be directly proportional to the steadiness with which they work. I know

of many instances where the men consider the rate of pay to be of lesser importance than the privilege of working 26 days per month. The fact that intermittent work exists on railroads should not be attributed to the executives. Railroad earnings in many parts of the country are subject to highly seasonable fluctuations. Some railroads in the last half of the year will earn two-thirds or more of the annual revenue. This means that the first half of the year is lean and the last half fat and that corresponding fluctuations in operating expenses to keep step with the variations in gross revenues must necessarily be adjusted through maintenance expenditures.

The contentment of men employed on railroad maintenance work is greatly increased by surrounding them with healthful living conditions—sanitary section houses and yards, screened windows, well drained premises and a bright, tidy and cheerful house to live in. Some years ago our company inaugurated a plan to improve these conditions and a very great improvement in the morale of the forces has been observed. There is no doubt whatever in the minds of our management that the cost of the sanitary and medical treatment of our employees; of providing flowers and shrubs, grass seed and fences for section house premises; furnishing lawn mowers for keeping grass cut after working hours and of providing water supply for watering grass, flower beds, etc., in the dry season; providing sanitary wells where well water is used, and similar improvements has been much less than the improvement in the morale of the men. We would not think for a moment of returning to the former conditions.

To sum up, raising the standard of maintenance forces has been and can be accomplished by raising the standard of supervision and by the creation of conditions for the laborers which will stimulate them to effective effort in the hope of qualifying themselves for promotion, while enjoying steady and continuous employment under working and living conditions which make for contentment.

The Roadmaster's Responsibility for the Promotion of Proper Relations With the Public

RAILWAY MEN generally, and the maintenance officers as quickly and as keenly as anyone, know how important it is that there shall be a proper understanding and friendly relation between the public and the railroads. If it ever existed, the so-called "Public be Damned" attitude belongs to the past. Progressive railroad men know what a friendly public means to the investor, to the employee and to the nation.

With a form of government under which the opinion and will of the public ultimately decides the policy and the law, it is essential that true facts be known by the people, so that the opinions formed and decisions arrived at will be based on correct information and therefore be right, just and fair to all concerned.

If the passage of laws that are undesirable and harmful to both the railroads and the people is to be prevented, it must be by making known to the public the actual facts and conditions under which the railroads are endeavoring to give to the country the service demanded and needed. The railroads are trying to put these facts and conditions before the people.

The trained and experienced men now operating and managing the railroads, who have spent years in learning the details, are without doubt qualified to direct the roads successfully. Only as freedom of action is given these men, under necessary and proper regulation to prevent discrimination and unjust practices, can the roads be successful. By "successful" is meant giving adequate and necessary service to the country and the public, paying fair wages to employees and earning sufficient income to attract the capital required to carry on the work and pay a reasonable return on the investment. Since the ability to do this depends on fair and just treatment from law making bodies, and this in turn is assured by the existence of a proper understanding on the part of the public, the importance of such understanding is evident.

Adequate Earnings Necessary

Only as a railroad earns the money necessary can it pay its employees a fair wage, and the earning of the money for wages depends on exactly the same conditions as the earning of money for dividends. Therefore, from a selfish standpoint, the importance of this matter to the employee is plain.

The standard of maintenance and operation on a road depends on the earning of the necessary revenue. If earnings justify it, the use of more material and larger forces will be authorized and a higher standard demanded. It is not necessary to point out what this means to the man who enjoys his work, as most maintenance men do. As the maintenance of way department is too often the first affected by a reduction made necessary by lack of revenue, the importance to a maintenance officer of the opportunity to earn on the part of his road is at once clear.

The present prosperity and power of this country, and the expansion and healthy growth of our neighbor, Canada, are based upon transportation. The railroads of North America are the foundation and about 90 per cent of the superstructure of transportation. History tells us that when this republic was formed, many able men believed that on account of the lack of means of communication, it could never extend farther west than the Mississippi river. The railroads demonstrated the fallacy of this and made possible the United States as it is today.

The Importance of a Friendly Attitude

Business depends on adequate transportation. This is realized as never before and is made evident in time of car shortage or other interference with the free movement of commodities. The ability to furnish the necessary trackage, terminals and equipment depends on earnings; and so also as it affects the ability to pay dividends and wages, the furnishing of the service demanded and necessary depends on the public will.

As stated previously the importance of a friendly public is very generally realized today. The committee in the foregoing has merely attempted to emphasize this fact and to point out the interest which every employee should have and why. An understanding and friendly public can be secured by making known to the people the problems the railroads have to meet and the methods and means being used in the effort to give service. Possibly more effective, however, is the personal work of each individual employee in making friends for the railroads of the people he meets, especially those with whom he comes in contact in a business way as a railroad representative. Many cases can be cited where failure to do this has resulted in

trouble and great expense for the railroads. The maintenance officer, in the performance of his own assigned work and as the man determining to a large extent the attitude and policy of those reporting to him, has opportunities and, having opportunities, has responsibilities peculiar to his department.

Your committee recommends that this association, representing the junior maintenance officers of the United States and Canada, go on record as urging upon, not only the membership, but on all maintenance men, the importance of a thorough understanding and friendly relation between the railroads and the public, and as pointing out the part maintenance men have to play in making this possible. Once all maintenance men are awake to the importance of this question and aware of the duty they owe to aid in bringing about the proper results, as a rapidly increasing number already are, they will be as alert and resourceful in discovering and adopting means and methods of accomplishing it as they have been in their regular work.

Two Methods of Approach

In considering means and methods two lines of attack are open to the officer supervising maintenance of way work:

1—His personal effort and what he can accomplish himself.
2—His influence in inspiring and training the men under him.

These are of equal importance. The things to be done are so many and so varied that the committee can only attempt to mention a few, among which are the following:

Handle promptly complaints or requests for repairs that are proper. The failure to repair a farm crossing, gate or fence; neglect of ditches and drainage; a stock yard or industry track in such shape that a car cannot be pinched along, have caused ill feeling and started agitation that was very troublesome and expensive to overcome.

Approach these matters as a neighbor. That is your relation, as the representative of the railroad to the farmer and land owner. Approach them as a salesman with service and transportation to sell. This you are to the shipper and traveling public.

Put yourself in the farmer's place and realize the feeling engendered if a crop almost ready to harvest is ruined because the railroad blocked the drainage, or stock is killed because of a defective fence. Settlement may be made and damages paid. This, however, is a direct loss to the railroad and very often does not restore the friendly feeling that once existed. We, of course, know that unreasonable claims are made in some cases, but that is only an added reason for preventing the cause.

Do not make promises that you do not expect to or cannot make good. Nothing is more aggravating than to be put off with fair words. Good intentions are counterfeit. Impress upon your foremen that they also must be governed by these same principles. They come in contact with many people you never see. Insist that a foreman keep a neat and attractive place if he lives on company property and do all possible to encourage him to do so if he owns his own home. The foremen and the agents represent the road to many people. The president and the board of directors are judged by what the local representatives are and do. Impress this upon the local man. Make him feel it. The foreman whose home surroundings are neat is usually a competent man and his work shows it. On one road the man charged with selecting men for promotion to positions as roadmasters visits the headquarters of foremen under consideration and learns first hand how they stand in their home town as citizens and neighbors. A similar plan might be followed in selecting men for promotion to a place as foreman.

Let your foreman know that you trust and respect him. He is your representative. Insist that every one else respect him. Permit no one to belittle or abuse him. Help and encourage the foreman to win for himself and family a place in the town and community. If he is on the school board, a member of the local council or some similar position, it is indicative of the regard his neighbors have for him and through him for the railroad he serves. Where the local man is so regarded, as a rule the railroad has little trouble in that community.

Impress upon the management, if necessary, what a neat home for the foreman means, both to him and to the standing and reputation of the road. Many executives are alive to the importance of this, but some are not, and it is the roadmaster's place to drive it home.

Use care in selecting crossing flagmen and give time to their training. In this day of a nation on rubber tired wheels, it is hard to estimate the number of people who form their opinion of a railroad from their contact and experience with a crossing flagman.

Maintenance Officer Has Many Opportunities

The maintenance officer is as progressive as any in advancing the welfare and interests of his company. Many have done more along this line than suggested by the committee in the foregoing. A few are lagging behind. There is no means as effective as personal work and contact. The maintenance officer has many opportunities as he goes about his work. The committee urges that he be more diligent than ever to watch for and take advantage of them.

Another opportunity open to roadmasters and other maintenance officers, and since the opening is there so is the responsibility, is to be adequately informed regarding railroad affairs so as to be able to correct many wrong impressions which exist. In the past the activity and responsibility of a roadmaster may have been limited by the right of way fences and the ends of his division. This is no longer the case. The roadmaster of today has a wider field and a greater opportunity. We frequently hear persons who may be well informed in many ways discuss railroad problems and suggest cures and changes. Having a very hazy, indefinite or actually incorrect knowledge of railroad affairs, they usually reach wrong conclusions and form opinions detrimental to the welfare of the roads. It is the opinion of the committee that we will be better employees and better maintenance men as well if we learn something concerning the questions so often discussed. For this reason we list a few of the more important issues below:

Some Railroad Questions

The Transportation act generally, and the so-called "Guarantee Clause" especially, is often misunderstood by the public. The railroads are not guaranteed a certain and definite return on their investment as is so often stated. The ability to explain this may remove a prejudice and win a friend for the roads.

Freight rates, so often given as the cause of business depression, are such that on most of the common commodities a reduction of even 25 per cent would mean little to the individual, but would mean financial ruin for the railroads.

The Illinois Central recently made computations which proved that the freight on the articles used in serving a dollar dinner in Chicago was 1.2 cents, some of the items coming from points as far away as Florida, Kansas, California and Colorado.

The Burlington not long ago issued a statement showing freight charges on certain common articles as follows:

On a suit of clothes, Chicago to Denver, 1,000 miles, 11 cents.
On a pair of shoes, St. Louis to Denver, 7.4 cents.
On a farm wagon, Chicago to Denver, $15.07.
On a sewing machine, Cleveland to Denver, $2.68.
On a 24-lb. sack of flour, Minneapolis to Burlington, Iowa, 4 cents.
On 10 lb. of sugar, New Orleans to Omaha, 6 cents.
On a bushel of wheat, Burlington, Iowa, to Chicago, 8.7 cents.
On cattle or hogs, Albia, Iowa, to Chicago, 1/3 cents per pound.

When the selling price or cost of these articles is considered it is evident how small a part the freight rate plays.

Prosperity of the Country and the Railroads Inseparable

It is beginning to be understood that the prosperity of the entire country is inseparably connected with the prosperity of the railroads. We should all be able to prove this. We should know what the railroads actually pay for such items as locomotives, cars, coal, rail, ties and taxes, and of the wide distribution and great number of people whose earnings and prosperity depend to a very large extent on the purchases made by the roads. The railroads employ about 1,850,000 persons and railroad purchases amount to about two billion dollars a year.

The elimination of grade crossings is a live subject at present. Many people think this work should be done without delay and at the expense of the railroads, but they have no conception of the total cost. In 1922, 706 crossings were eliminated on the railways of the United States at a cost of $70,000,000, and it is estimated that to do away with all grade crossings would cost $22,000,000,000. Mention of these facts and figures will at least cause people to pause and

These are only a few of the subjects commonly discussed regarding which so many people are misinformed. Many roads distribute from time to time pamphlets giving correct information. Take advantage of these. Have the facts and make judicious use of them. Do not hesitate to give actual information. A roadmaster has many opportunities, on trains, with a farmer along the right of way, among elevator men or stock shippers at the station, to say a few words that may correct a wrong opinion and win a friend and supoprter for the railroads. Since we have the opportunity, let us assume the responsibility.

Committee: H. R. Clarke, general inspector permanent way, C. B. & Q., chairman; George E. Boyd, Railway Review; L. M. Denney, supervisor of track, C. C. C. & St. L.; J. P. Davis, engineer maintenance of way, C. I.; F. T. Beckett, district engineer maintenance of way, C. R. I. & P.; John F. Whitney, assistant engineer, B. & M.; A. M. Clough, supervisor, N. Y. C.; A. L. Kleine, roadmaster, A. T. & S. F.; H. M. Smith, roadmaster, N. & W.; B. E. Haley, general roadmaster, A. C. L., and J. B. Baker, engineer maintenance of way, Penna.

Discussion

A. M. Clough, N. Y. C., stated that much could be gained by acquainting the men in the gang with some of the problems of railway management, particularly the cost of maintenance of way work. For example, it is his practice to tell his foremen the cost of track materials so that they can appreciate the necessity for economy. P. J. McAndrews, C. & N. W., pointed to the opportunity of the maintenance of way officer in obtaining favorable publicity for the railroads by effecting a close relation with the editors of local newspapers. He cited his own experience in the case of some rail renewal work. By furnishing the editor with some interesting material concerning the nature of this work he was able to present facts on the large expenditures which the railroads incur in maintaining their tracks in condition to handle the traffic effectively. Mr. Clarke called attention to the fact that the report as presented could only cover a bare outline of the many ways in which the roadmaster could be of assistance to the railroads in developing a more cordial relation between the public and the carriers and that he was sure that many roadmasters were carrying on work of this kind along lines not covered in the report.

How to Inspect and Identify Ties for Renewal

THE QUESTION of tie renewals is of sufficient importance on all railroads, due to the growing scarcity of timber, to warrant unified action by all having supervision of the roadbed, to the end that the timber will be conserved and give its full life to the service required at minimum expense. The practice on all railroads is uniform, in that the line is divided into sections. A competent man who has served his apprenticeship in the section gang is appointed to the position of section foreman and a certain number of men perform all maintenance work on the section under his direction, this maintenance work including not only taking care of the property as they find it but the renewal of ties, rails, other track material, etc.

Tie renewals are governed by the locality and density of traffic. In some localities, due to climatic conditions, ties will not last as long as at other points, while ties will deteriorate by reason of mechanical wear much quicker in some lines of heavy traffic than in others of lesser density of traffic, so that the length of time a tie should be retained in service cannot be decided arbitrarily but most be governed by local conditions.

The committee feels that a foreman is selected by his roadmaster because he has been found to be a loyal employee of the company for which he works and endeavors to reduce his expenses to the minimum. This means that, when repairing track, the roadmaster desires to renew only the ties that are necessary and, therefore, instructs every foreman that no ties should be removed from track which will give a year's additional service. This limit should not be held if rail renewals are in progress or if the track is being given a general raise, as, under these conditions, ties which will last only a year should be removed, but ties which will give two years' additional service should be allowed to remain in spite of rail renewals or a general raise, providing they are not quarter or joint ties; if such, they should be shifted to an intermediate tie space, as track, when being raised or undergoing rail renewals, should be placed in such first class condition that it can be maintained for a year with little work except slight surfacing from time to time. In this connection the committee feels that each section foreman should raise and fully tie at least half his section each year, spotting in new ties to replace the unsafe

ties in the remainder of the track during the same year in order to keep the track in good condition for high speed or heavy traffic.

How to Make the Inspection

In general, the tie ispection is made late in the fall of each year after the tracks have been brought up to good riding condition for the winter. The ties are marked with paint or are adze-marked to indicate that they are to be removed the following year. At some points the condition of the tie as to fitness for service is ascertained by sounding with a spiking maul or the butt end of a tamping pick, but if the inspection takes place during the winter months this test for soundness of timber is uncertain. In addition, the sounding of ties does not give information as to the condition of the tie underneath the base of the rail or the tie plate. If mechanical wear is heavy, due to density of traffic, the wood underneath the tie plate or base of the rail is soft and does not provide the proper resistance to movement of the spike which should obtain under proper maintenance. With the general use of tie plates, the old method of sounding the tie to determine its condition has become insufficient and additional inspection must be made to determine not only the ability of the tie to hold the spike but also its fitness to withstand tamping. This inspection can be secured by using a sharp pointed instrument with which the timber underneath the tie plate or underneath the base of the rail, as the case may be, can be tested to determine if it is solid or to ascertain whether the soft portion of the tie extends to such a depth that proper spiking cannot be obtained after the tie is adzed, or that the thickness of the portion remaining after adzing will be insufficient to resist the strain of tamping under traffic. Therefore, the committee feels that, in the inspection of ties, the sharp pointed instrument combined with the sounding test made by a hammer or blunt end of a tamping pick across the grain of the wood about eight inches outside the rail is the best method for all purposes. A record should be maintained of the ties inspected in each track between mile posts, so that an accurate check may be made when actual renewals are made.

Committee Does Not Favor Employment of a Tie Inspector

On some roads the opinion prevails that a tie or timber inspector should accompany the section foreman on his inspection in order to eliminate the possibility of removing ties which might give further service. The committee feels, however, that the addition of a tie or timber inspector is not justified when his salary and necessary expenses are taken into consideration, as the inspection is made from surface indications, whereas the real question of tie removals arises when the actual track work is being performed. When such seasonal track work is under way, the section foreman, who received official recognition of his qualifications by his appointment, is responsible, and having been selected after being duly examined as to his ability and fitness for the work is to be considered as his having been assigned to the section to maintain it in as near perfect condition as possible at a minimum expense. The character of the foreman is such, in the experience of the committee, that his loyalty to the railroad which has given him his position causes him to vie with others in maintaining his tracks in better condition than the adjoining sections and to endeavor to do so by securing more efficient results from his men. As minor officers of the company, therefore, the section foremen should be held responsible for all ties removed from track under their jurisdiction. The ties removed from the track should be left on the right-of-way for a short time so that the supervisor, his assistant or the general foreman, as is sometimes the case, may thoroughly inspect them, so that ties removed which will give further service may be replaced in track and the foreman responible for their removal properly disciplined.

Foreman Appreciates Need for Economy

This practice might be considered by some as an ideal arrangement, or too nearly ideal, but the committee feels that we are living in an era different from that which has preceded it and that our foremen now realize that all railorads are being conducted upon purely business principles. This means that no material should be used which is not absolutely necessary, particularly the ties and timber, and that their life can be lengthened by proper tamping and by proper drainage of the sub-grade. We believe that the foreman, if taught to appreciate the element of cost, not only the original cost but the cost of maintaining ties and timber, and if shown how much better track can be maintained by the proper use and care of ties and timber, will produce such results that the method of inspection suggested will fulfill all requirements.

Committee: J. G. Hartley, division engineer, Penna., chairman; Dan Foley, inspector of maintenance of way, M. C.; C. H. Schriers, A. T. & S. F.; J. E. Bone, roadmaster, M. P.; D. K. Newmyer, roadmaster, S. P.; Henry Ferguson, superintendent of track, C. N.; C. J. Franklin, assistant to general roadmaster, C. M. & St. P.; J. Seaburg, roadmaster, N. P.; George J. Daly, supervisor, Erie; J. P. Corcoran, roadmaster, C. & A.; J. W. Powers, supervisor, N. Y. C., and W. T. Hanley, division engineer, Penna.

Discussion

The discussion which followed the reading of this report centered almost entirely on the question of employing system tie inspectors to review or check the opinions of the division forces in determining what ties should be renewed. R. S. Belcher, superintendent of timber preservation, A., T. & S. F., said that the employment of tie inspectors had proved of definite value on the Santa Fe in determining the primary causes of failure. The inspectors were not employed to check up the roadmaster and foreman but to discuss with them conditions necessitating the removal of ties. J. B. Kelly, M., St. P. & S. S. M., favored the employment of a tie inspector as the only means of obtaining uniform conditions over an entire system. He also said that it was a mistake to determine the ties to be renewed in the fall and favored a fall inspection only as a preliminary to the final inspection in the spring.

J. W. Griffiths, K. C. S., opposed the employment of a tie inspector on the ground that no one can make the inspection better than the foreman or roadmaster, to which Mr. Kelly replied that he did not believe that the average roadmaster would find time to make a detailed tie inspection over his entire district without neglecting more important duties. P. J. McAndrews, C. & N. W., said that the answer to this was to reduce the size of the roadmaster's district. However, he questioned whether it was necessary for a roadmaster to check the inspection of every one of his foremen, for he believed that 90 per cent of them could be trusted to make the inspection without supervision.

S. D. Cooper, A. T. & S. F., pointed to the value of the tie inspector as a means of obtaining accurate information as to the cause of the failure of ties, stating

that in the absence of the tie inspector he had found that foremen and roadmasters were inclined to report the cause of failure in all cases as decay, whereas an investigation disclosed that the cause in many cases had been mechanical, but had not been so reported. In general, however, the prevailing opinion of those who discussed the report was that the tie inspector was not necessary; that inasmuch as the roadmaster was held responsible for the condition of the track in his district his authority in the matter of tie renewals should not be divided with that of a tie inspector. The report was accepted without change.

Means of Prolonging the Life of Rail

ASSUMING THAT the rail and the track have been well maintained, the question before this committee is to determine what else affects the life of rail and what can be so done as to prolong its life. Factors which enter into this question include the following:

1—The quality of the rails when new.
2—The handling of rails.
3—The correct laying of rails.
4—Chipped and battered end rails.
5—Defective and damaged rails.
6—Rust.
7—Worn joints.

Perhaps other factors might also be considered, but the committee decided that these are the most important and that they cover as much ground as could well be handled in one report.

Quality of the Rail When New

The effect which the quality of the rail has upon its life is well demonstrated by the condition of much rail which was manufactured many years ago, when compared with almost any rail which has been manufactured and laid in recent years.

The wearing quality of the old time rails is shown by some historical sketches, of old rail, which were secured by the committee. One reads as follows:

We now have a great deal of trouble with the rail on the low side of curves battering and flattening on the ends and flowing out on the sides. I believe that if the gage on the curves was kept perfectly tight, it would help a great deal. My personal opinion, however, is that the railroads should insist on getting better rail to start with. They made them 30 years ago and I don't know of any good reason why they can't today.

"Attached is a blue print of a 72-lb. rail manufactured by the Illinois Steel Company and laid on this railroad in 1893, with a six-hole, 44-in. angle bar joint. This was laid where we have fairly heavy traffic. We handled from one million to two million tons of ore over this track this year, in addition to other freight and passenger trains. An average of 16 to 18 trains per day pass over it.

"This track is partly on a three per cent grade. The empty ore cars move out on another line but all the loaded cars move over this track down a three per cent grade for about five miles and it is mostly on curves of from one to three degrees. We have never had a broken rail, a rail with an internal fissure, a split ball or a piped rail on this steel.

"We do not have the chemical analysis of this rail, but it is rather high in carbon. I understood at the time we laid it that the manufacturers thought we would have trouble with broken rails on account of it being too hard, but we have never had any,although the temperature often goes to 25 deg. below zero.

"We also have about 150 miles of 60-lb. steel in our main track that was laid in 1887 and 1888, and is still in service although on this part of our line the traffic is not so heavy, averaging possibly ten trains daily. This rail is of course worn out and we expect to take it out soon. In this same territory where we have this 60-lb. and 72-lb. rail, we have some 80-lb. rail that has been in service only 12 years and yet the joints are battering and flattening out so badly that we have been welding them with the oxweld process."

Many similar cases could be quoted, but the information is the same. The rails manufactured 30 or 40 years ago are still standing up without mashing and without battered joints, even though laid with ½ to ¾ in. openings between rail ends.

It would seem the part of wisdom to have chemical analysis made of samples of old rails which have given excellent service and to use similar chemistry in some test installations of rails made by modern methods and to modern dimensions.

Handling of Rails

Few people apparently realize how much damage can be done to rails by careless handling, but it is a fact that many rail failures are the result of careless unloading, a careless stroke of a spike maul, etc. For instance, on one road where all failed rails are held for inspection by a representative of the chief engineer, it has been found that in 75 per cent of the split web rails, where the crack is down in the middle of the web, or angling across the web, spike maul marks are to be found on the web, usually on the side opposite the beginning of the crack. Where blows from a spike maul in the web of a rail are so plainly a cause of failure there can be little doubt that similar blows on other parts of the rails also cause failures at times. The remedy is, of course, careful handling.

Correct Laying of Rails

Next to the effect of the quality of the steel upon the life of rail, the manner of its laying in track probably has more to do with its life than any one other factor. By manner of laying of rails is meant:

A—Whether or not it is laid with proper space between rails to take care of their expansion in warm weather.
B—Whether or not the low ties are surfaced up promptly or shims used to prevent the bending or kinking of the new rails.
C—Whether the new rails are being anchored promptly to preserve the distribution of the expansion space.
D—Whether the proper jointing of the rails, lining of track, etc., is being done.
E—Whether the rails are canted inward so as to present a normal bearing of the head to the tread of the wheels, or whether they are laid with the axis of the rail vertical, regardless of the bearing of the wheels.

The first factor in the correct laying of rails is to provide sufficient space between the rail ends to take care of the expansion of the rails in warm weather. Naturally this is of the most importance when rails are laid in cold weather, and of less importance as the weather conditions, when the rail is being laid, approach the maximum temperature which the rail will have to undergo while in service.

The second factor bearing on the correct laying of rails, the prompt surfacing up of low ties, must be given careful attention to avoid damage to the rails by bending or kinking, in the same spots where the old rails were down.

The third factor, the prompt anchoring of rails in place, is necessary to prevent the rails creeping, with consequent bunching, causing tight joints at some localities and open joints at other places.

The fourth factor mentioned, which really is a grouping of several factors, covers the prompt and correct bolting up of joints, and doing other work necessary to put the newly laid rail in the best possible condition. Not the least of these is the necessity of lining of the new rail. Twenty years or more ago it was no

uncommon thing to see a railway track lined so accurately that not a quiver from a straight line could be seen as far as the eye could reach, but with the present railway track conditions, accurate lining of track is a lost art. This unfortunate fact is largely due to two practices. One of them is the laying of rails vertical, thus providing a poor bearing for the wheels on the rails. The other cause for poor alinement is the practice of laying rails too tightly, that is, with insufficient room between the rails for expansion.

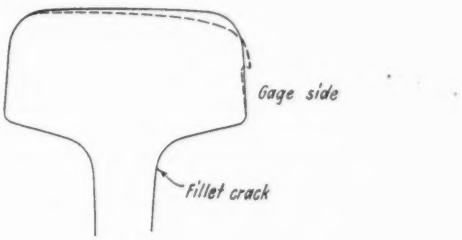


Fig. 1, Head Contour Showing Side Worn Condition

The importance of providing for the expansion of the rails is shown by the fact that a rail 33 ft. in length will increase 1/16 in. in length for each 25 deg. of rise in temperature, and a rail 39 ft. in length will increase 1/16 in. in length for each 20 deg. increase in temperature, or in one mile the rails will increase 8.24 in. in total length.

If rails are laid tight at a temperature of 20 deg. they will lengthen 32.95 in. in each mile when their temperature reaches 100 deg., or 45.30 in. when their temperature reaches 130 deg., which is a common temperature in the sun in the summer. This extra length is not dissipated into the air nor is it bluffed out of existence by tight laying, but it is taken care of either by the kinking of the rails at the joints, curving, bending and bowing the rails until the extra length of rails is taken up in bad alinement of track, or until a "sun-kink" occurs and the track shifts to one side bodily, producing a serious peril for trains. Where there are curves in the track the extra length of rails on hot days will usually take care of itself by pushing the curve outward, thus producing bad alinement of the curve. These are some of the results of laying of rails without providing sufficient space for expansion.

Item E, that of canting the rails inward, is at least of equal importance to the necessity for providing for the expansion of the rails. Those opposing the use of canted tie plates and the resulting canting of rail, and consequently defending the laying of rail vertical are not defending an old and long established practice, as they seem to think, for, previous to the use of treated ties it was the general practice to cant the rail inward by adzing the ties enough to make the rail head show the wheel bearing in the center of its face. This was not called canting but was known in those days as laying the rail so that it would show "a good face," or "a full ball" and when the rail laying job was completed and the "brass collars," as they were then called, made their inspection trip, woe to the roadmaster if his new laid rail failed to show "a good face."

With the advent of treated ties the adzing of ties was no longer good practice because of its damage to them and, to avoid damaging them by adzing, the practice of laying rail vertical was adopted for the protection of the ties and without any thought or consideration of the damage which it might do to the rails and the wheels. The practice was not the result of careful thought or well considered experiment, but, like Topsy, it "just growed."

The results to the rails, of vertical laying are:

1st—The wearing and mashing down of the gage side of the rail head until the face of the rail approaches the line of taper of the wheel. Only a glance at the contours of rails, as shown in Fig. 1, is necessary to show this side-worn condition of the rails.

2nd—The rolling out of a bead, or "hang over," along the gage edge of the rail head; this is also shown in Fig. 1.

3rd—Within the last five or six years a new type of rail failure has become noticeable, in the form of a crack in the web at, or very near, the line of connection of the fillet, under the head, with the top of the web. Investigations have made it quite evident that this kind of failure is due to eccentric loading of the rail.

4th—For several years past rails have been showing more and more results of wear in the shape of black "wear" spots along the gage edge of the face of the rail head. These spots first appear as small black spots the size of a finger nail, or smaller, and increase in numbers, along the rail, and in size with continued traffic over the rail, until they split out along the gage side in fibrous slivers or until they develop into mashed spots across the rail head. Their origin is so uniformly along the gage edge of the rail that it is evident that they are due to the concentration of the load there, due to the vertical position of the rail. See Fig. 2.

5th—Since the vertical laying of rail has become the common practice, the alinement of track has deteriorated very noticeably and it requires only a test of canted tie plates to prove that the line of the rails is much better where they are canted inward than where laid vertical.

6th—The wear of the wheels due to contact with the rails is bound to be at the point of contact, and the depth of wear is governed by the width of bearing. With rails laid vertical, a new wheel must make contact with a new rail well toward the inside edge of the rail and near the flange side of the wheel. This must result in wearing a groove in the wheel deepest near the flange and not normal to the face of the wheel. If the rail is canted to the same extent as the taper of the wheel the bearing between the two is normal to each, and the wear more nearly preserves the taper of the wheel than will any other form of contact.

Wheels are tapered to make them run true and smoothly, and this is accomplished by the taper providing a greater circumference of the wheel close to its flange than at the outer edge of its tread. This causes the pair of wheels, when diverged by any cause, to bring themselves back to the position at which their circumferences, at their points of contact with the rails, are the same. It is, therefore, important that the taper of the wheels be preserved as accurately as possible.

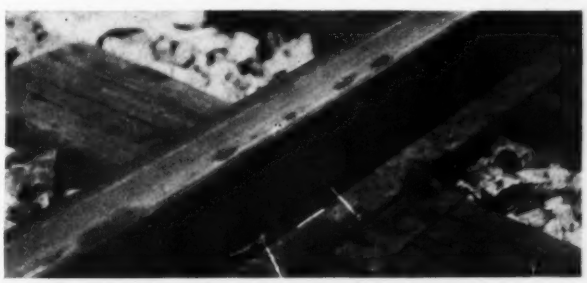


Fig. 2, Black "Wear" Spots Near the Gage Side of the Tread

For these reasons it is necessary, if the greatest possible life is to be gotten out of rails, that they be laid canted to the same extent as the taper of the car wheels. To do this, and at the same time protect the ties, canted tie plates should be used.

Chipped and Battered End Rail

Two causes are largely responsible for chipped and battered end rails. One is the quality of the rail itself,

and the other is the laying of the rail too tight without sufficient space for expansion.

Prior to the change in the chemistry of rail steel a battered end rail was found occasionally but the occasions were not frequent, as is proven on the many miles of the old rail still in tracks. Some of these old rails have seen 40 years or more of service, and are in most cases laid with excessive expansion space, yet in many cases one can search for miles without finding a battered rail end.

On the other hand, rails of recent manufacture usually show battered ends within three or four years, and in many instances they have become so numerous that they compel the replacement of the rail at half the service which it should give, and would give except for them.

The chemistry of the rail steel, however, is by no means the whole cause for battered end rails, as a great many of the battered end rails result from the chipping of the rail ends. And in almost every case of chipped end rails, the rails are either tightly together or have been tightly together, as is proven by the depression in the face of one rail end made by the overlap from the other rail end. The projecting metal rolled out from the head of a rail will not overlap the adjoining rail if there is any opening between them, but will turn downward between the rails. When the contraction of the rails in cold weather produces an opening between rails previously tight the overlap rolls downward, forming a projection beyond the part of the rail end lower down, and when hot weather again brings the rails tight, the pressure on this projection splits a chip out of the face of one or both rails, thus producing the chipped end and the beginning of a badly battered end rail.

There is nothing more important in the laying of rail than providing the proper space for expansion. Insufficient space for expansion is far more injurious to the condition of the rail, to the alinement and surface of the track, and produces a greater menace to trains than an excess of space left for expansion.

Damaged rails are of numerous kinds, the most common being no doubt those damaged by spinning drivers. Other types are kinked rails, rails damaged by broken wheels, rails bent or twisted by wrecks, etc.

Rails burned by spinning drivers are rarely burned deeply enough to do any damage unless the engine drivers are allowed to run longer than necessary. Driver burns of consequence are, in most all cases, the result of indifference or temper on the part of the engine man, and can be prevented if every engineman can be made to realize that the damaged spot in the rail which he makes by slipping the driving wheels needlessly may be the gateway to his own grave.

Remedies for Damaged and Defective Rails

While the preceding has dealt with the factors which affect the life of rails, and the prevention of such conditions, some remedies are available for prolonging the life of rails after they have become damaged or faulty in some respect.

The remedy which should be mentioned first is the building up by some welding process of rail ends which have become chipped or battered. This properly comes first because it is a remedy which can be applied to the rails in track as soon as the damage occurs.

During the last half dozen years the practice of repairing battered rail ends by welding, either by gas or electric processes, has grown and is proving both successful and economical. The first attempt at repairing battered rail ends by welding, of which the committee has knowledge, was made on the C. & N. W. at West Allis, Wis., near Milwaukee. This attempt was made by the Oxweld process, and while the work was rather rough and crude as compared with present day results, is was so successful that after two years it was difficult to recognize the rails which had been repaired, without examining the sides of the rail head where there was no wear to smooth down the welded metal.

On the Valley division of the A. T. & S. F. six miles of new rail was requested in the spring of 1917, to replace, in 1918, an equal mileage of 90-lb. rail which was laid in 1910. The rail was to be replaced solely because of the excessive number of battered ends. In the autumn of 1918 five additional miles of rail was ordered under the same conditions. The rail in track was inspected and found to be in good condition in all respects except battered ends, but they were so numerous that it was deemed necessary to renew the rail "out of face," and new rail was authorized for the purpose.

Rail deliveries were somewhat slow in those years, and when the autumn of 1919 arrived and the rail had not been received, it was decided to try repairing the battered ends by welding. An oxweld gang was started to work about November 24, 1919. The work was successful from the start, but improved in quality as the work progressed. The building up of the rail ends proved so successful and so satisfactory that the entire 11 miles of new rail, when received, was released to another division for replacement of rail which had worn out, throughout its length, and the rail on the Valley division, replacement of which was authorized in 1918, is still in its original location and good for at least a year or two more of service.

From this beginning the repairing of battered end rails on the Santa Fe has grown until the total number of joints reported as having been welded, up to December 31, 1924, amounts to 165,000 and the cost for the work has averaged $1.675 per joint (two adjoining rail ends). The cost of welding battered end rails varies, of course, with the amount of batter which has taken place before the work is done.

On the C., B. & Q., oxwelding is reported as having been done for $0.80 per joint, but it was not stated whether this covered both labor and material, or labor only. On the C. & O. oxwelding of joints is reported as having cost $1.95 per joint. This undoubtedly includes labor and material, as it is about the same as on the Santa Fe during the first year or two of the practice.

The building up of chipped and battered rail ends not only prolongs the life of the rail, but it reduces the cost of keeping the track in good surface, as it is difficult to keep the joint ties up where the joint is chipped or battered. It also helps to protect the ties from wear which would otherwise result from the pounding of the wheels over the bad rail ends.

Sawing Off Rail Ends

As the battering of rail ends become more frequent and troublesome it sometimes becomes necessary to remove rail from track "out of face" for this cause alone. In such cases the rails are generally in good serviceable condition except for a few inches at each end, and it is found desirable to have the worn ends of the rails sawn off and the rails redrilled, after which they frequently are suitable for reuse in the same class of track from which they were removed. This process is preferable to rerolling, because it preserves the fishing spaces of the rails unimpaired, which is not always the case with rerolling. It also preserves the hard face of

the rail (the service temper) that has been produced by the cold rolling of the car wheels and which helps to resist further wear. This the rerolling process does not do. In addition, the resawing of the rails is much cheaper than rerolling.

The cost of resawing rail is reported to have been as low as $0.79 per ton, although it usually runs higher than that. The American Railway Engineering Association reports that the average cost per ton for sawing rail, as reported by 20 railways, amounts to $1.79 per ton, not including freight.

When rails are being resawn the cut off should include the entire length of the joint bars, in order to remove the wear of the joint bars on the under side of the rail head, and thus give the joints a full and true bearing when the rails are relaid. New joint bars should be used in relaying resawn rail, for the old joints are usually more badly worn than the rail being removed.

The cost figures here given are for the actual work of sawing and handling the rail at the mill or saw; the freight charges are not given as obviously they depend upon distance and whether shipment is entirely over the owning road or partially over a foreign line. When rail must be removed from track the resawing is unquestionably the most economical and satisfactory method of reconditioning it.

Rerolling Rails

For badly worn and battered rails, the first remedy to attract general attention was to send the rails to a rerolling mill and have them rerolled to a slightly smaller section. By this process the decrease in the size results in an increase in the length of the rail so that it is cut off to its original length. With increasing costs of labor and fuel the expense of this process increased until it now costs above $14 per ton for rerolling, not including freight.

In service the rerolled rails proved very erratic, giving satisfactory results in some cases and very unsatisfactory results in others. As a consequence, the rerolling of rail has practically been abandoned, except for rails which are curve worn, rails with badly roughened heads, rails which are twisted, and rails which are so badly bent or kinked that they cannot safely be straightened cold. For the reconditioning of such rails rerolling seems to be the only process available.

Rails which are to be rerolled should be separated into classes, according to defects, before rolling, and after rerolling all rails of each class should be stamped with some letter or mark to identify its class, so that a study of results can be made. For instance, it would be interesting to know whether or not the rerolling of driver burned rails will make them safe for further use in running tracks. In many cases such rails can be used more economically in sidings than by rerolling.

Rust Is Another Factor

The sixth factor in life of rails as outlined above is rust. Near the sea coast, or bodies of salt water, and, perhaps more seriously on tracks which carry a considerable number of refrigerator cars in which salt is used to aid the cooling, considerable damage is done to rail and track fastenings by rust.

A reasonably satisfactory remedy for this is found in the rail oilers, consisting of pneumatic machines which spray oil over the rails, below the face level, as the machine is drawn along the track. Oiling of rail should be done in dry weather, when dust is more or less prevalent, as the dust will then settle into the oil and form a coating over the rail which becomes an excellent protection against brine or moisture of any kind.

The results of such oiling are reported to be very satisfactory and where the tendency to rust is very bad its benefits are found to be far greater than the cost.

Worn Joints

The seventh and last factor in the life of rail which the committee listed is worn joints, or more properly, joint bars. There is more wear of the joint bars and of the rails where the bars are in contact with them than is generally appreciated. In the case of the joint bars this is particularly aggravated directly under the ends of the rails. It frequently happens that after six or seven years in track the wear of the bars becomes so great that the rail ends begin to dip down at the joints in spite of all maintenance efforts. It then becomes advisable to replace the joints with new or repaired joints which do not have the worn faces.

A process has recently been developed to recondition the rail joints by heating them to a forging temperature and passing them through a forging press, thus restoring the bar to its original fishing fit. From the forging press the bars go to a heat treating vat and are turned out to their original outside dimensions and re-heat-treated. Only such joint bars as are of good material and of sufficiently high carbon to make the heat treatment effective should be selected for such reconditioning.

After securing the information given above, the committee has reached the following conclusions:

Conclusions

(1) That the chemistry of the old rails which have given many years of excellent service, and which are still to be found in branch lines and sidings, should be used as a guide for test installations of rail of modern dimensions and made by modern methods.

(2) That in laying rails sufficient space should be provided between rail ends to take care of the expansion of the rails due to all probable increase in temperature above that at which the rails are laid.

(3) That rails should be canted inward when laid, by the use of tie plates canted to the same pitch as the taper of the wheels, viz. 1 in 20.

(4) That battered and chipped end rails should be repaired, preferably by welding in track, but if for any reason the rails are to be removed from track soon, the reconditioning should be done by sawing off sufficient of the rail ends to remove the wear of the joint bars in addition to the wear of the face of the rail at the ends. Welding should not be done on a main track rail outside of the limits of the joint bars.

(5) That all rails known to be defective and all rails having damaged spots sufficient to cause any doubt as to their safety should be removed from main track at once and the remainder of their usefulness gotten out of them in a side track.

(6) That rails exposed to the action of salt water or salt air should be oiled sufficiently often to protect them from the effects of the salt.

(7) That where the rail ends are being damaged or are beginning to acquired a permanent dip due to wear of the joint bars, the bars should be replaced by new or reconditioned joints.

Committee: C. W. Baldridge, assistant engineer, A. T. & S. F., chairman; William Shea, general roadmaster, C., M. & St. P.; W. R. Wires, roadmaster, C., B. & Q.; J. E. Cullin, division engineer, L. V.; W. R. Groshell, roadmaster, A. T & S F.; P. J. McAndrews, roadmaster, C. & N. W.; G. W. Morrow, supervisor, N. Y. C.; William Wharry, general road-

master, C. N.; W. H. Sparks, general inspector of track, C. & O.; D. E. Callahan, supervisor, Penna.; M. Henry, supervisor, C. & E. I.; T. F. Donahoe, general supervisor, B. & O., and H P. Stafford, assistant general roadmaster, D. S. S. & A.

Discussion

The discussion which followed the reading of the report was generally favorable to the recommendations of the committee. Some question was raised as to the necessity for allowing for expansion in laying rail to the extent called for in the report but this position was not sustained. J. B. Martin, N. Y. C., asked if joint bars should be renewed when rails are welded or sawed, to which Mr. Baldridge replied in the affirmative. J. B. Kelly, M., St. P. & S. S. M., contended that one cause contributing to chipped rail ends was the burr left on the rails when they are sawed in the mill. He believed that rails should be milled on the ends. It was also his experience that rails are not always sawed square and that in his opinion this was one of the causes of kinked track.

J. W. Powers, N. Y. C., questioned the economy of re-sawing rails and believed it was cheaper to sell rail as scrap than to re-use it. He criticized the report for omitting the item of transportation in giving figures on the cost of re-sawing, to which Mr. Baldridge replied that it was impossible to insert the freight charge because this would depend on the distance that the rail had to be moved, which would be different in each individual case. However, he felt that there would be no difficulty in demonstrating the advantage of re-sawing if all items of cost were considered. In answer to Mr. Kelly he said that poor alinement of track or kinked rail was due primarily to two factors, one, laying the rail too tightly, and the other, bolting too tightly. With the heat-treated high-carbon bolts now used it is readily possible to bolt the joints so tightly as to produce substantially the same effect as if the rail were laid tight in the joints.

The Track Supply Exhibit

AS STATED in the introduction to the convention report, the exhibit of the Track Supply Association was held in the Municipal convention hall adjacent to the space used for the convention sessions, this space being considerably larger than that available in previous exhibits and making it possible for the companies exhibiting to present their displays in an attractive manner. Fifty-nine companies presented exhibits.

The officers of the Track Supply Association to whom the success of the exhibit is largely due, are as follows: Acting president, L. C. Ryan, (Oxweld Railroad Service Company), Chicago; secretary-treasurer, W. C. Kidd (Ramapo-Ajax Corporation), Hillburn, N. Y.; directors, Alex Chapman (The Rail Joint Company), Chicago; J. H. Horn (National Lock Washer Company), Newark, N. J.; F. McAllister (Kalamazoo Railway Supply Company), Kalamazoo, Mich.; W. W. Glosser (Verona Tool Works), Pittsburgh, Pa.; advisory directors, E. T. Howson (*Railway Engineering and Maintenance*), Chicago; R. A. VanHouten (Sellers Manufacturing Company), Chicago; ex-officio director, J. J. Cozzens (Union Switch & Signal Company), New York; honorary director, W. F. Muff, president of the Roadmasters' and Maintenance of Way Association, Newton, Kan. The list of firms exhibiting is given below:

List of Exhibitors

Air Reduction Sales Company, New York; oxygen, acetylene and carbide, cutting and welding apparatus and regulators, lamp carbide and railroad carbide lamp; R. T. Peabody, T. M. Hamer, C. A. Daley and G. M. Smith.

American Chain Company, Inc., Bridgeport, Conn.; guard rail clamps, replacers, rail benders, one-piece guard rail, compromise joints; J. J. O'Connell and W. P. Burleigh.

American Hoist & Derrick Company, St. Paul, Minn.; illustrations and photographs of ditchers and caterpillar shovels; Miss H. M. Hoeller, W. B. Maurer and D. L. O'Brien.

American Steel & Wire Company, Chicago; fencing and posts; E. R. Waterman, L. P. Shanahan, J. W. Collins and J. M. Holloway.

American Valve & Meter Company, Cincinnati, Ohio; interlocking and gearless switch stand and safety locking device; J. T. McGarry, D. J. Higgins and F. C. Anderson.

Balkwill Manganese Crossing Company, Cleveland, Ohio; model of an articulated cast manganese steel crossing; S. Balkwill, T. P. Cagwin and E. D. Rogers.

Bethlehem Steel Company, Bethlehem, Pa.; switch stands, hook flange, guard rail, lock nuts, gage rods and warning signs; N. E. Salsich, Rex Deghuee, R. S. Malone, F. Huffman and W. Chapman.

Boston & Maine, Boston, Mass.; working model of Mount Washington railway; E. S. Jones.

Buda Company, Chicago; section motor car, tool grinder, motor car wheels, track drill, track jack and track lever; G. W. Hoover, A. L. Bliss and J. H. Weare.

Carbic Manufacturing Company, Duluth, Minn.; carbic light, acetylene welding and cutting apparatus and carbic cakes; R. C. Duncan and V. A. Leaveau.

Chausse Oil Burner Company, Elkhart, Ind.; oil burning switch heaters and kerosene thawing and heating torches; W. McK. White and E. R. Mason.

Chicago Malleable Castings Company, Chicago; rail anchor, tie plates, anti-creepers and bumping post literature; Warren Osborn.

Chipman Chemical Engineering Company, Inc., Bound Brook, N. J.; T. B. Bowman.

Cleveland Railway Supply Company, Cleveland, Ohio; flangeway guard, foot guard, guard rails, switch stands and photographs of locomotive cranes; F. A. Peck, W. H. Neeson and H. P. Blum.

Creepcheck Company, Inc., Hoboken, N. J.; creepchecks; Frank J. Reagan.

Crerar Adams Company, Chicago; hand and power bonding drills, track drill, rail saw, die starter, jacks, track liners and handles; Russell Wallace and W. I. Clock.

Duff Manufacturiing Company, Pittsburgh, Pa.; track, journal and bridge jacks; Earl E. Thulin.

Fairbanks, Morse & Co., Chicago; section cars and motor car windshield; F. M. Condit, P. H. Gilleland, G. W. Lewis, C. H. Wilson, E. C. Golladay, B. S. Spaulding, C. B. O'Neil, A. J. Olson, G. Howard, C. G. Mahana, George Johnson, E. E. Pendray, Charles Gross and H. L. Hilleary.

Fairmont Railways Motors, Inc., Fairmont, Minn.; section car, light inspection car, motor car engine and motor car two-speed transmission; W. F. Kasper, W. D. Brooks, L. R. Payton, J. T. McMahon, and E. R. Mason.

J. R. Fleming & Son Company, Scranton, Pa.; switch point protector; A. J. Fleming and J. A. Moffitt.

Grip Nut Company, Chicago; grip nuts; J. B. Whitenack.

Gustin-Bacon Manufacturing Company, Kansas City, Mo.; track liner; Glen R. Miller.

Hackmann Railway Supply Company, Chicago; track liner; Frederick Hackman, Joseph J. Franzen, Roy O. Emery and Arthur Schmidt.

Hayes Track Appliance Company, Richmond, Ind.; derail and operating stand, light portable derail and bumping post; Herbert J. Mayer, S. W. Hayes, Sterling P. Reid and E. L. Ruby.

Hubbard & Company, Pittsburgh, Pa.; shovels, track tools and nut locks; J. S. Wincrantz.

Ingersoll Rand Company, New York City; pneumatic tie tamper, rail drill, nutting machine, shovel, wood boring tool, bonding drill, concrete breaker, rock drill, hammer and chipper; W. H. Armstrong, E. F. Kultchar and T. H. Weigand.

O. F. Jordan Company, East Chicago, Ind.; moving pictures; A. L. Greenbaum, J. C. Forbes, E. J. Van Patten and A. W. Banton.

Kalamazoo Railway Supply Company, Kalamazoo, Mich.; motor car and combination track gage and level; Frank E. McAllister, L. W. Boswell and R. E. Keller.

Kansas City Oxygen Gas Company, Kansas City, Mo.; welding and cutting equipment; R. E. Koons and L. D. Kelly.

Koppel Industrial Car & Equipment Company, Koppel, Pa.; photographs of air dump car; W. H. Redman and O. E. Kantenwein.

Lundie Engineering Corporation, New York City; tie plates, rail anchors; L. B. Armstrong and George W. Nibbe.

Maintenance Equipment Company, Chicago; friction car stop, track tools, moving pictures of rail layer, power ballast screen, skeletonizing machine, power track ballaster and combination tie plate; J. A. Roche, C. Woodings and Cyril Woodings.

Mechanical Manufacturing Company, Chicago; bumping post; H. E. Johnson.

Mudge & Company, Chicago; motor cars, Albert C. Force, Clyde P. Benning, F. C. Whitehouse, V. Pagett and Walter Ryser.

National Lock Washer Company, Newark, N. J.; spring washers; W. R. Hillary and R. L. Cairncross.

Northwestern Motor Company, Eau Claire, Wis.; heavy duty motor car; F. W. Anderson, A. H. Nelson and William J. Roehl.

Oxweld Railroad Service Company, Chicago; welding apparatus; L. C. Ryan, W. H. Kofmehl, C. A. Bloom, E. M. Collins, A. S. Jones and F. J. Lynch.

P. & M. Company, Chicago; anti-creepers and bond wire protectors; D. T. Hallberg, P. H. Hamilton, J. E. Mahoney, G. E. Webster, R. D. Hawley and J. J. Gallagher.

Pocket List of Railroad Officials, New York; copies of publication; B. J. Wilson.

Positive Rail Anchor Company, Marion, Ind.; girder type guard rail, rail anchors, rail braces, guard rail plates and braces and tie plates; A. H. Told and L. C. Ferguson.

Q. & C. Company, New York City; one-piece manganese guard rail, guard rail clamp, compromise joint, derails; J. L. Terry, E. R. Packer, R. J. McComb and L. Thomas.

Rail Joint Company, New York City; insulated joints, compromise joints, standard joints, track liner and motion pictures; Alex Chapman, C. B. Griffin, H. C. Hickey, J. N. Meade, C., A. Disbrow, Charles Jenkinson and M. Markley.

Railroad Supply Company, Chicago; tie plates; W. S. Boyce, R. E. Bell, George T. Cook, J. W. Jordan, George T. Willard and R. S. O'Brien.

Railway Engineering and Maintenance, Chicago; copies of *Railway Engineering and Maintenance*, Maintenance of Way Cyclopedia, Roadway and Track, Simplified Curve and Switch Work; E. T. Howson, F. C. Koch, W. S. Lacher, J. M. Rutherford and H. Porch.

Railway Review, Chicago; copies of publication; J. A. Walsh and G. E. Boyd.

Ramapo Ajax Corporation, Hillburn, N. Y.; automatic switch stand, manganese crossing, double shoulder switch plate, manganese guard rail, guard rail clamp, forged braces; W. C. Kidd, J. B. Strong, J. E. Davidson, T. E. Akers, Dickson Fairback, W. J. Fairback, J. V. Houston, Paul Hoffmann, D. E. Hilton, R. W. Payne and George M. Cooper.

Reade Manufacturing Company, Jersey City, N. J.; model of chemical weed killing machine; Charles H. Reade and Ralph W. Pritchard.

Reliance Manufacturing Company, Massillon, Ohio; spring washers; H. J. McGinn, A. C. Rule, R. Shireman, E. W. Hart, W. H. Crawford and E. C. Gross.

Sellers Manufacturing Company, Chicago; wrought iron tie plates; G. M. Hogan, R. J. Platt and R. A. VanHouten.

Sinning Track Liner Company, Ramsey, Ill.; track liners; F. R. Sinning, J. A. Moffitt, Frank J. Reagan and A. F. McCool.

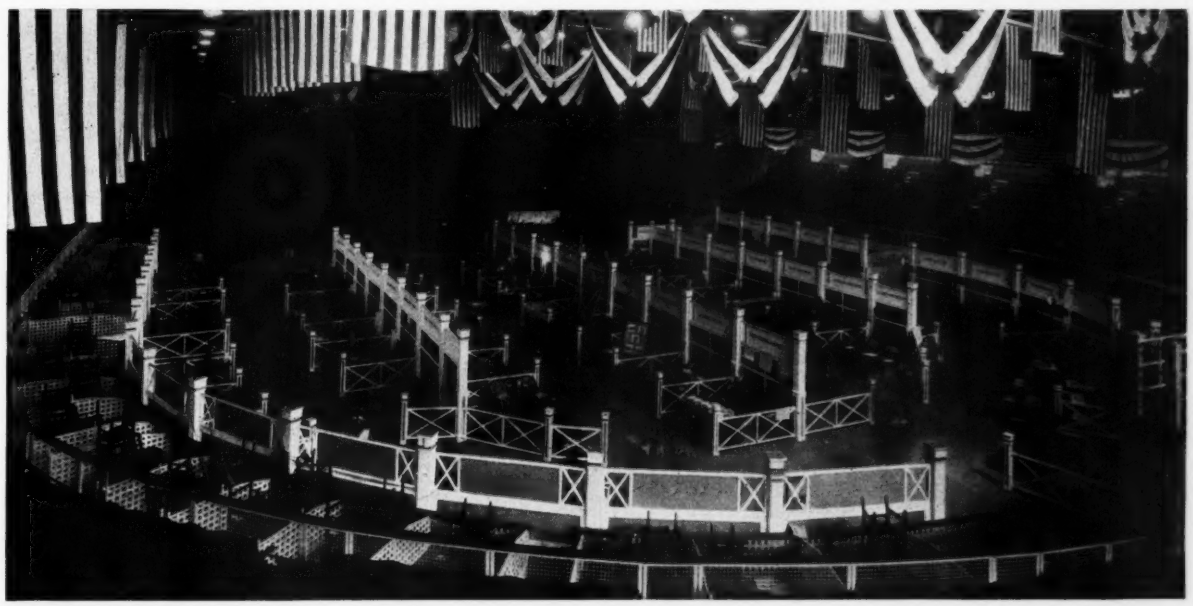
Skelton Shovel Co., Inc., Dunkirk, N. Y.; track shovels; E. W. McCarty and H. C. Branahl.

Templeton, Kenly & Co., Ltd., Chicago; track jacks, bridge jacks and emergency jacks; James L. Crowley, George L. Mayer and W. B. Templeton.

Union Switch & Signal Company, Swissvale, Pa.; insulated rail joints; J. J. Cozzens.

Verona Tool Works, Pittsburgh, Pa.; track tools, nut locks, track jacks, rail joint springs, rail anchors, track liners and circuit bonds; W. W. Glosser, W. C. Dawkins and C. Laessig.

Warren Tool & Forge Company, Warren, Ohio; adzes, crowbars, lining bars, picks, spike mauls, sledges, hammers, track chisels, wrenches; M. J. Konold and H. C. Mull.



A View of the Track Supply Exhibit

Western Wheeled Scraper Company, Aurora, Ill.; model of automatic side dump car with apron, and moving pictures; Jess Mossgrove and P. F. Smith.

Woolery Machine Company, Minneapolis, Minn.; motor car engines and parts; H. E. Woolery and C. G. Tambornino.

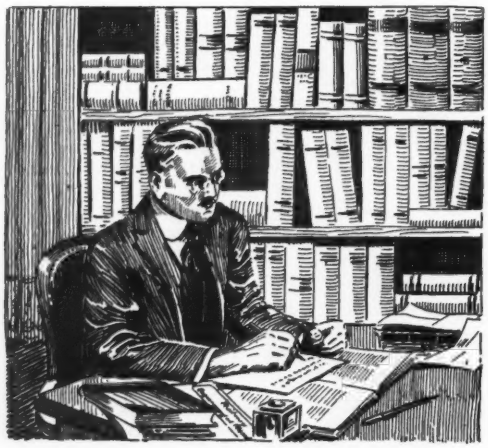
Wyoming Shovel Works, Wyoming, Pa.; track shovels, spades, scoops, scuffle hoes and picks; H. T. Potter, E. L. Ruby, Stanley H. Smith and M. S. Hendrickson.

Non-Exhibiting Members

Barber Asphalt Company, Philadelphia, Pa.
Cleveland Frog & Crossing Company, Cleveland, Ohio.
Morden Frog & Crossing Works, Chicago.
National Malleable & Steel Castings Company, Cleveland, Ohio.
Pettibone-Mulliken Company, Chicago.
Railway Purchases and Stores, Chicago.
St. Louis Frog & Switch Company, St. Louis, Mo.
William Wharton, Jr. & Co., Easton, Pa.

At the annual meeting of the Track Supply Association on Wednesday, the following officers were elected for the ensuing year: President, L. C. Ryan, Oxweld Railroad Service Company, Chicago; vice-president, A. H. Told, Positive Rail Anchor Company, Marion, Ind.; secretary-treasurer, W. C. Kidd, Ramapo Ajax Corporation, Hillburn, N. Y.; members of executive committee: L. P. Shanahan, American Steel and Wire Company, Chicago; J. Howard Horn, National Lock Washer Company, Newark, N. J.; W. W. Glosser, Verona Tool Works, Pittsburgh, Pa., and F. C. McAllister, Kalamazoo Railway Supply Company, Kalamazoo, Mich.

What's the Answer?



This department is designed to serve as a reader's service bureau, wherein the many problems which arise in the routine maintenance of tracks, bridges, buildings and water service facilities, may be subjected to frank and thorough discussion. The value of the service thus rendered is proportionate to the extent to which readers avail themselves of it, in submitting questions and in lending their co-operation by offering answers to the questions presented.

Questions to be Answered in the December Issue

1. Where section gangs are reduced to a "winter basis" of two or three men and a foreman, what work should they be expected to do during this season that will insure their being employed constructively?

2. What are the reasons for skinning piles for use in the foundations of piers and abutments?

3. What are the relative merits of three-throw split switches and the lap arrangement of switches? Does the three-throw switch involve any special problems of maintenance?

4. To what extent can wooden trestle decks be repaired or renewed in winter?

5. To what extent are maintenance forces warranted in devoting time to cleaning up and improving the appearance of the right-of-way, particularly about depots and other facilities accessible to the public? In what direction, if any, are beneficial effects evident?

6. Under what conditions may wall board be used in place of plaster?

7. Would the maintenance of continuous guard rails be improved by having a slightly lower guard rail for the high side (to compensate for worn treads) and a slightly higher guard rail for the low side?

8. Should hydrant pits be packed with sawdust or other material to prevent freezing? If not, how should they be protected?

Can Valves Be Repaired in the Line

Is it possible to repair a leaky water or steam valve in service and thus avoid replacing it with a new one?

It Depends on the Nature of the Repair

By John M. Fitzgerald
Office Engineer, Central of Georgia, Savannah, Ga.

The answer to the above question depends upon the nature of the repairs needed. If the body of the valve is damaged it is usually necessary to remove it. If other parts are to be repaired they can be removed after shutting off the valve, closing the opening by a blind flange and thus restoring the line to service. After repairs are made the parts can be replaced in the same manner. Generally it is not necessary to remove a valve in order to make repairs.

Repair Is Cheaper Than Replacing

By W. B. Bryant
Inspector Water Service, Illinois Central, Chicago

Leaky water or steam valves can be divided into two classes for this discussion. One class includes those valves which may be tight fitting at the valve seat but leak around the stem or where they are attached to the pipe line. The other class include those valves in which the valve seats have become so defective that the valve will no longer control the flow of the water or steam in the line.

Where valves leak at the stem the trouble is usually in the packing. Ordinarily these leaks should be repaired by tightening the packing gland or by renewing the packing, both of which can be done while the valve is in position, it being required only to cut off the service in the line temporarily. In some cases leaks of this kind are caused by bent valve stems. Valves are sometimes replaced to correct the trouble, but usually such repairs can be made by renewing the stem without going to the expense of installing a new valve.

In those cases where valves leak at the connection with the pipe line the trouble is more serious. This is particularly true with steam lines. Usually there is only one satisfactory remedy. This is to take the line out of service and remove the valve because the trouble is either a loose connection which cannot be tightened without removing the valve or a pipe line which has become weakened by pitting and requires rethreading or entire renewal. In some cases, however, acetylene welding has proved an effective remedy for such leaks and even where welding is not to be recommended as a permanent remedy it is often useful for making emergency repairs. When using the acetylene torch, however, it is in the interest of safety to shut off all flow of steam or water in the line. While leaks of this character may require the removal of the valve it is to be remembered that repair may not require a new valve for the trouble may have some other cause. What the cause is should be carefully ascertained before going to the expense of valve replacement, particularly in the case of large lines where the valves are expensive.

The majority of valves, both water and steam, are probably removed because of defective valves and seats, which prevent complete closure. The requirements in this case will depend largely upon the kind of valve and the size. Gate valves are never used on steam lines but are frequently installed on water lines of two inches and over where a large unrestricted flow of water is important. Ordinarily gate valves can be repaired by renewing the gate, ball and stem, which can be done without disconnecting the valves from the line. The majority of valves used on the steam lines and similar water lines are globe valves. While it is usually the inclination of repair men to replace leaky globe valves it is possible in most cases to make repairs by regrinding the valves and seats and this can often be done without disconnecting the valve. Replacements are required only where the valve and seat are found to be so badly cut as to make regrinding out of the question. In recent years manufacturers have developed valves with removable discs or seats or both, the purpose of such valves being to make it unnecessary even to replace a valve when the seats are worn beyond repair, the remedy in such cases being merely to replace the worn part. These valves have proved very effective in reducing the cost of valve maintenance.

When all is said and done it is only possible to determine whether or not a valve can be repaired without replacing it with a new one by a study of the trouble in each case. But it is safe to say that in most cases repairs can be made and should be made without the expense of disconnecting and scrapping a serviceable valve and replacing it with a new one.

Motor Cars Must Be Kept Oiled

What rules should be followed to insure the oiling of motor cars?

The Requirements Must Be Thoroughly Understood

By Lem Adams
Roadway Assistant, President's Staff, Union Pacific, Omaha, Neb.

No one thing in the operation of motor cars is of more importance from the angle of maintenance than the proper lubrication of all bearing surfaces. Lack of lubrication or the use of a poor quality of oil is the most common cause of failures and replacements.

The best oil is the most economical from every standpoint, and careful consideration should be given the selection of an oil which will not break down under high temperatures and cease to function as a lubricant. A good grade of heavy oil should be used in summer, and for winter use an oil that has the same qualities but which will flow freely in low temperatures is desirable.

Motor cars can be given two general classifications; first, the four-cycle cars, which use straight gasoline for fuel and depend on lubricating the working parts of the engines from a supply of oil carried in the crank case oil reservoir, distribution being made by force feed circulation or a pump and splash system; second, the two-cycle type cars, which use a mixture of fuel and lubricating oil.

A few simple rules will greatly assist in taking care of the oiling of the more important parts of a motor car.

1. Motor Cars Using a Mixed Fuel. (Two-Cyle Type.) (a) A definite proportion of oil to gasoline that will give proper lubrication should be determined upon and the proportions accurately measured. Too much oil produces a slow burning mixture, causes excessive heating and spark plugs to foul and results in a waste of fuel. Insufficient oil will bring destruction to all bearing surfaces.

(b) In mixing the oil and fuel, about one-fourth the quantity of fuel needed should be placed in the measure and the entire amount of oil needed should be added. This should be thoroughly agitated with some metal instrument similar to the spoon-shaped wire egg beater. A wood paddle would do, but is more difficult to keep free of foreign matter, such as sand, slivers, etc. After this portion has been mixed, the container should be filled and the contents again stirred vigorously.

2. Motor Cars Using Straight Gasoline and Straight Oil in Crank Case. (Four-Cycle Type.) (a) Oil should be poured through a funnel which has a 20-mesh wire screen soldered in the mouth of the outlet to prevent foreign matter entering the crank case. Care should be taken to allow sufficient time for the oil to reach the reservoir so that a proper gage reading may be obtained. This is especially true in extreme cold weather when oil will cling to the crank case walls and not run down freely.

(b) Observe the oil gage reading every morning before the car is taken out and after every 50-mile run.

(c) Care should be taken to run the engine slowly until it has gradually warmed up to insure proper circulation of the oil to all bearing surfaces, as bearings can be burned out with the reservoir full of oil unless it is warm enough to circulate freely.

(d) In filling the fuel tank it is good practice to pour the fuel slowly through a fine mesh wire screen in the funnel, so that foreign matter does not get into the tank, and if a little care is used, it will be found that the larger particles of dirt and any water will accumulate in the bottom of the measure. This, with the last few ounces of gas, should not be used.

3. Oiling of Magnetos. (a) Two or three drops of a light oil like that used for sewing machines should be used in each of the hinged lid oil cups every 1,000 miles. Do not use too much, as it will get into the breaker points and cause them to short or burn out. In time, it is also injurious to the wiring, etc.

4. Timers. A good practice is to keep all roller contact timers filled with a good, clean, soft grease; cup grease will do, but a grade something like vaseline will be much better.

5. Axle Bearings. Roller bearings should be lubricated with an oil that will flow freely; either black oil or light gas engine oil can be used and a sufficient quantity should be used to fill all the cavities in the rollers and also the housing in which they rotate, so that a small quantity will be observed working out the ends of the bearing cages. This oil serves to lubricate the lateral collars and carry away any foreign matter which would otherwise accumulate at this point. After the bearing cages have been filled, a small quantity of oil should be added each morning. On long runs, more frequent attention is needed.

6. Loose Wheel Bearing. It is very important to keep the loose wheel well lubricated and it should have attention at least once each day.

7. Chains. Very little if any good can come from pouring oil on the outside of a chain. They should be kept clean and free from grit and dirt. The best practice seems to be to remove the chain every two or three months, clean it with kerosene and dry it thoroughly, then submerge in a pan of melted tallow or heavy grease which has been heated so that it will flow freely. It should then be allowed to stand in the oil for 30 min. and wiped dry before again applying it to the car.

General. On many direct-connected cars, the engine is mounted on the rear axle and grease cups are provided.

These should be kept well filled and screwed down a turn at a time every hour's run after the car has been broken in.

In answering the question, "What rules should be followed to insure the oiling of motor cars?", the most important thing of all would be to assign one man in the gang to the oiling of the motor car, and his first duty when he reports in the morning should be to thoroughly oil around before taking it out. This same man should be responsible for keeping the car clean and the nuts and bolts tight.

Oiling Should Be Done by Driver of Motor Car

By C. L. Deming
Roadmaster's Clerk, Chicago, St. Paul, Minneapolis & Omaha, Sioux Falls, S. D.

To insure the oiling of a motor car properly the driver of the car should do this himself, following the rules below:

(1) Make sure that all oil cups, grease cups and oil holes are free from dirt or other foreign obstructions.

(2) Inspect the oiling system each day, particularly oil cups, grease cups and oil holes, making sure that oil reaches the proper places.

(3) Observe regular oiling periods, with the proper grade of oil, such as recommended by the manufacturer of the motor, engine or car.

(4) Occasionally wash out all oil cups, oil holes and bearings of the car and motor with gasoline and a small paint brush to remove any dried oil, dirt or other accumulation, to insure clear oil ways.

(5) Protect oil holes and oil cups in such a manner as to keep dirt out by the use of plugs, or small leather flaps, both on the motor and the car. Never use more oil than necessary, i. e., never run the oil cups or oil holes over, thus allowing dirt to collect. Wipe the car and motor daily and keep them clean to prevent the accumulation of dirt and grease.

The most effective measure to take to make sure that the car is oiled properly is to select one man to whom the driving and the care of the care can be trusted, both for the operation of the motor and the safety of all concerned. If the foreman drives or runs his own car he should follow these rules and thus give the motor and car its best service at all times.

A good grade of oil and lubricant with a good body, such as the manufacturers of the car and motor recommend, should be used. Poor oils cause trouble. The cost of good oil represents but a very small percentage of the upkeep of a motor car.

When a rainy day prevents the use of the motor car or outside work, the oil cups and oiling places can be washed out with gasoline. If the motor is oiled from the crank case, it should also be drained several times a year to remove the dirty, worn-out oil and the settlings, washed out and refilled with fresh oil. If lubricant is mixed with gasoline, it is well to have a can of this mixture prepared in advance for use, as the gasoline will cut the oil better. Never pour the lubricant into the gasoline tank of a motor unmixed, as this will settle to the bottom and clog up the fuel line. As a matter of safety the motor car tank should be filled during daylight, say at the return from the day's work. At this time the oil cups should be filled also, thus in any case of emergency during the night time the motor car will be ready for a trip all but the oiling of parts provided with oil holes and the oiling of the loose wheel.

Where a long trip is planned it would be well to oil the running gears of the car and the loose wheel several times during the trip or day. In some cases the cars are equipped with grease cups. These should be tightened up to insure the hard oil reaching the bearings. All movable parts should be oiled well but not in excess; better often with a small amount than a lot of oil at one time daily or even longer. Before any trip is started the driver of the car should be sure the car is oiled and that the oiling system is working properly.

A properly oiled motor car will start much better, run more evenly and have more power on less fuel than a poorly oiled car. A poorly oiled car will land in the junk heap sooner than a well cared for motor which has had the proper attention in oiling and upkeep. Anyone can tell a well cared for motor or car by the general appearance. One that is all covered with oil, dirt, etc., is probably given a bath from an oil can once in a while and never wiped off. A clean car is usually one that is taken care of by one man only, and not the whole gang.

Laying Roofing Over Old Shingles

When renewing an old shingle roof with composition roofing or composition shingles is there any objection to applying the new roofing directly over the old?

It Is Not Good Practice

By N. H. LaFountain
General Supervisor of Bridges, Chicago, Milwaukee & St. Paul, Chicago

We know by experience that the laying of roll roofing or composition shingles over old wooden shingles, is not good practice for the reason that the surface on old shingle roofs is so rough that it is practically impossible to nail the new roofing properly without damaging it. This is especially true in the laying of lightweight roll roofing.

Furthermore, unless roll roofing is laid on a smooth surface, without voids under it, it is quite liable to be lifted and blown off by high winds. In their printed advertising matter, some composition roofing manufacturers specify that their roofing must be laid on a clean, smooth surface for the best results.

When Is a Wire Rope Worn Out

What evidences of distress or deterioration may be noted in a hoisting cable as indicating that it needs to be replaced?

It Deteriorates in Three Ways

By Hoisting Engineer

A wire hoisting rope that is not overloaded deteriorates from three causes—wear, excessive bending and corrosion. The first is a normal service experience. The effect of this can be reduced by conscientious lubrication but will take place nevertheless and eventually will reach a stage requiring replacement. Wear is primarily a surface condition and can be readily detected by occasional inspection. Excessive bending of a wire rope, the result of using it with sheaves of too small diameter, is the potential cause of deterioration and can be avoided by using sheaves of the diameter specified for each size of rope in the tables commonly appearing in the handbooks or catalogs issued by wire rope manufacturers. Excessive bending causes the breaking of the outside wires of the strand of a rope and is readily detected.

The corrosion of wire rope is the most serious source of deterioration because it is not readily detected. Ordinarily corrosion takes place only on the sides of the strands next to the core. There is usually enough grease or oil on the sheaves of a hoisting rig to preserve the outside of the rope, but not enough to protect the interior.

Consequently, wire rope may be badly corroded on the inside without any evidence of this on the outside. Because corrosion results in an unnecessary shortening of the life of wire rope and because it may cause a rope to be in a dangerous condition without its having been detected, it is important that wire rope be kept coated with a suitable dressing or lubricant to afford thorough protection against the action of the elements.

Just when a rope is in such a condition as to require replacing is largely a matter of judgment based on experience and cannot be defined with any exactness. A rope that shows considerable wear or breakage of wires should not be continued in severe service, but need not necessarily be discarded, for it may be transferred to some service where the loads are not so severe and particularly where it will not be subjected to sudden loads or jerking.

Should Special Draining Be Provided

Is the installation of a line of drain pipe under the curb of a station platform advisable as a drainage measure? At what minimum depth should it be placed to avoid danger of breakage?

Drain the Curbs

By E. R. Lewis
Principal Assistant Engineer, Michigan Central, Detroit, Mich.

Efficient drainage is a prime factor of structural permanence. Drains for railroad platform curbs are necessary elements of good construction. Nothing is more disappointing than to face early and extensive replacement of structures built with a view to permanency. Absence of or inadequate drainage is responsible for many such failures, notably in station and other platforms.

Most platforms are crowned with a view to carrying drainage to the curb. If drains are not provided settlement back of the curb is likely to occur gradually, due to the accumulation of water and the action of frost, with a tendency to heaving and deterioration. The decision as to the depth of such drains below the ground surface depends on climatic as well as construction conditions. The drain should be below the frost line, usually not less than two feet for locations in the middle states. This depth brings the drain at about the bottom of the footing of the curb. It may be laid in the trench dug for the curb and is readily placed against the toe of the footing on the track side.

Looking for Rail Failures

How frequently and in what manner should a foreman make a detailed inspeciton of the rail in his main tracks for indications of failures?

It Depends on Conditions

By C. W. Baldridge
Assistant Engineer, Atchison, Topeka & Santa Fe, Chicago

This is one of the questions which it is impossible to answer because the answer which fits one location will not fit another. However, a review of the things to be looked for, how they should be looked for and where they should be looked for, will help each foreman to realize when they should be looked for on the particular piece of track of which he is in charge.

The things to be looked for consist of defective rails, which include split heads, mashed spots in the heads, longitudinal cracks in the heads, flaws in the metal of the rail heads, etc.; split or cracked webs, cracked or broken bases, etc.; broken rails, either clear brakes anywhere in the length of the rail, or breaks within the joint bars; and fillet cracked rails, as shown in the picture.

There are also head-checked rails. These are usually found on curves, and the sharper the curve and the steeper the grade, the more likely are the head checks to develop. Fortunately head checks give more warning than do any other type of break which is common. The head check condition of rails consists of fine lines looking like minute cracks in the face of the rail, beginning in the gage edge and extending from one-fourth inch to an inch across the face of the rail.

Watch should also be kept at all times for driver burned rails, kinked rails and rails damaged by broken wheels, and prompt report made of all such cases found. The "how" of the inspection should be about as follows: Always be on the lookout for broken rails.

Section of a Rail Showing a Fillet Crack

At least once a week the foreman should sit on the front end of his car and ride over his track at not more than 10 or 12 miles per hour and watch the rails, on one side only, for mashed spots and defective spots. In doing this he should watch about 1 or 1½ rail lengths ahead of the car. At that distance flat spots are readily seen, particularly on a slightly cloudy day. On the return trip he should inspect the other rail.

Broken rails can best be found by an inspection made on foot, but they should be watched for on all trips over the section by car or otherwise. Section cars should always be run slow enough to permit the rail to be clearly seen, and some members of the crew should always be on watch for broken or faulty rails.

The foreman should inspect rails personally on sharp curves where traffic is heavy at least once each week. His inspection of rails on curves should be made on foot, examining for head checks and also looking for fillet cracks by getting on his knees or by using a mirror.

Whenever either head check or fillet crack conditions are found the roadmaster should be advised and he also should make inspections frequently enough to insure keeping well in touch with the situation. Both fillet cracks and head checks sometimes occur on tangents but not often, but if these conditions are being found on curves the rails in tangents should be carefully inspected by the foreman at least every three months.

The frequency of inspection may be stated about as follows: On important heavy traffic main line, inspect all rails for flat spots, defective spots, etc., from a slow

running motor car once each week; inspect rails on sharp curves for head checks or fillet cracks on foot, once each week; and on lighter curves proportionally; inspect all rails for head checks, fillet cracks, cracked webs, cracked or broken bases, etc., on foot once each three months, keeping watch for such defects at all times. Be always on the watch for broken rails.

Where to Use Second Hand Bolts and Spikes

Should second hand track bolts and spikes be used in main tracks?

Use New Material in Main Tracks

By Bernard Blum
Engineer Maintenance of Way, Northern Pacific, St. Paul, Minn.

It is assumed in this question that only good usable material is involved, as it should be clear that track bolts with defective threads, bolts that have been stretched beyond the elastic limit in service or spikes so badly rusted as to present a cross section considerably less than the original size and spikes that have become neck cut, should not be re-employed in a track of any importance.

On the Northern Pacific it has been the practice for some years to use new track bolts and spikes in relay work on main tracks. In main tracks of main line the matter of track bolts has usually solved itself as most of the relaying work has been with rail of heavier section for which second-hand bolts were not available. On branch lines where second-class rail was being placed it has been customary to use new bolts with nut locks and save such salvaged bolts as could be used again for yard and back tracks. Similarly we have made it a practice to use new spikes for main track work and in the case of out-of-face relays, to ship all of the recovered spikes to the reclaim yard, straightening and rattling the good, serviceable spikes for use in secondary tracks. We have considered that the savin made in the labor of relaying in main track has justified the handling of the material in this manner.

Placing Bents Under Weak Girder Spans

What precaution must be taken in blocking up a weak girder span on temporary bents to make it safe for traffic until it can be replaced?

It Must Be Done With Care

By Bridge Engineer

While this problem is one which does not arise frequently on most railroads, it is one that must be considered carefully whenever it is imposed. To insure safety and effectiveness of the blocking, three important points must be carefully watched: First, stability or security of the bent or bents against scour or the action of drift; second, insurance against settlement of the bent so that they will continue to take loads from the girder until it is renewed; third, adequate provision for application of the load by the girder to the bents at the points of support.

The first point is easily provided for if the stream bed permits of driving piles that will develop adequate load carrying capacity with sufficient penetration to insure stability of the bent, security against scour and resistance to the pressure of drift. If the river bottom is rock or rock covered with an insufficient covering of sand or soil to hold a pile bent and the only solution is a frame bent set on the rock, the problem becomes a much more serious one. If the location is one subjected to swiftly flowing water and a considerable volume of drift, the use of frame bents for this purpose cannot be recommended.

Where a frame bent is used it is essential that it is secured against longitudinal movement at the top and may require longitudinal sway bracing, but where this is not permissible, stability must be obtained by means of a secure fastening of the cap to the girder which may well be considered under the second heading mentioned above, for, if the girder has a firm bearing on the bent there is little likelihood of any movement of the bent.

If a bent is to be effective in taking load, the girder must have a firm bearing on the bent and this is usually accomplished by wedging. One method of doing this is to provide double caps with double oak wedges between the two caps, driving them in from the two sides. With the upper cap thus wedged and with rivets on the under side of the lower flange pressing into the cap, there is little likelihood of any movement of the bent relative to the girder.

The third requirement, that of provision for the application of the load by the girder to the bent at the point of support, is one that may easily be overlooked. Nevertheless, it is of great importance. The ends of girders, as ordinarily constructed, are provided with stiffener angles which act as vertical columns to transfer the load from the top flange and the web to the sole plate. Intermediate stiffeners are designed solely to stiffen the web and being crimped over the flange angles are not constructed to act as columns like the end stiffeners. Therefore, even if the supporting bent is placed directly under a pair of intermediate stiffeners it is necessary to reinforce the girder against crippling or buckling over the bearing point. This can best be done by providing a pair of temporary bearing stiffeners in the form of two timbers, say 4 in. by 6 in. in section, bolted against the web on each side by means of bolts passing through holes drilled through the web, these timbers to be cut to such length as to make a drive fit between the inside faces of the top and bottom flange angles of the girder.

Riveted and Screwed Pipe Railings

What are the relative merits of riveted and screwed connections for pipe railings?

A Further Answer to an Old Question

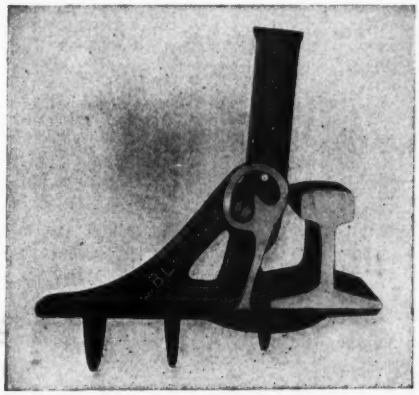
By R. J. Bruce
General Supervisor Bridges and Buildings, Missouri Pacific, St. Louis, Mo.

In my opinion screwed connections make for firmer work, and also present a neater appearance. Connections should be screwed together so that no threads appear. Riveted work costs about the same and does not present as good an appearance and, furthermore, may become shaky in time.

Landslide Blocks Tunnel—Tunnel No. 4 in Miravalles canyon about 20 miles south of Tepic on the new extension of the Southern Pacific of Mexico, was damaged by a landslide on August 22. About 5,000 cu. yd. of material slid into the approach cut, burying the south portal and a large rock weighing about 200 tons settled four feet into the portal. This tunnel was opened in February, 1924.

A New Track Liner

A RECENT addition to the devices for the lining of track is the Bloxham track liner, manufactured by the Chicago Steel Foundries Company, Chicago. It consists of two pieces, a base or anchor and a lever. The base member consists of a steel casting in the form of a horizontal plate with prongs on the lower side to engage the ballast and two ribs on the upper side which provide the necessary support for a double notched seat or hinge joint for the lever. The lever is also a steel casting having the form of a socket for a lining bar at one end and a shoe at the other, and is provided at mid-length with



The Bloxham Track Liner

a one-inch shaft by means of which it is supported in the seat provided in the base member. Both the base and the lever are made of electric steel.

The manner of operation will be readily understood from an examination of the illustrations. The forward end of the base is pushed under the rail so as to be in contact with the lower side of the rail base, the prongs being pressed into the ballast. With the liner in this position a pull on the lining bar placed in the socket of the lever causes the shoe on the lever to bear against the edge of the rail base, forcing it over. The leverage is such that a pull of 150 lb. on the lining bar exerts a pressure of 1,800 lb. against the side of the rail and it is said that two or three pulls on the lever will line the rail over about one-half inch. However, by providing a double notch in the socket of the base it is possible to line the track over considerably more than one-half inch without heeling up the base a second time. This is done by setting the lever so that the pin rests first in the rear notch, then after the track has been lined over about one-half inch, lifting the lever until the pin can be set in the forward notch, after which the operation is repeated.

One point in connection with the design of this track liner to which the manufacturer calls particular attention is the fact that the lever is operated by pulling out and down. In a test of this track liner on the Pennsylvania near Fort Wayne, Ind., 100 ft. of track was lined over one inch and then lined back the same distance with three Bloxham track liners in 13 min., this track being laid with 130-lb. rail in rock ballast.

ROCK ISLAND TO HOLD CELEBRATION—The seventy-third anniversary celebration of the Chicago, Rock Island & Pacific, to be held in Kansas City, Mo., on October 12 and 13, will be the occasion for the gathering of representatives from all divisions of the system. An attendance of 2,000 is expected, including a large number of pensioners and members of the 25-year club; officers and employees who have been in the service of the Chicago, Rock Island & Pacific for 25 years or more.

With the Associations

American Railway Engineering Association

A committee has been appointed to arrange for the annual dinner as follows: J. R. W. Ambrose (Toronto Terminals), chairman, J. B. Cox, W. A. Christian, C. R. Knowles (I. C.), G. P. Palmer (B. & O. C. T.), L. J. F. Hughes (C. R. I. & P.), A. C. Irwin (Portland Cement Association), J. deN. Macomb (A. T. & S. F.), J. E. Armstrong (C. P. R.), and E. H. Fritch (A. R. E. A.). The committee already has a number of novel features under consideration which are expected to increase the attendance and interest above the high record established last year.

The Board of Direction met in New York on September 16.

The Bridge and Building Association

A special train will be operated by the Michigan Central from Chicago to Buffalo, leaving Chicago at 9 o'clock on Sunday evening, October 18 and arriving at Niagara Falls on Monday forenoon. Opportunity will be afforded the members to visit the falls and the new Michigan Central bridge across the Niagara Gorge, recently completed. The party will arrive at Buffalo on Monday afternoon where the convention will be opened on the following morning.

The Supply Exhibit

Forty-two companies have already taken membership in the Bridge and Building Supplymen's Association and arranged to present exhibits contemporaneous with the convention of the Bridge and Building Association. These companies include the following:

American Hoist & Derrick Co., St. Paul, Minn.
American Railway Hydrant & Valve Co., Stapleton, N. Y.
American Valve & Meter Co., Cincinnati, O.
Asbestos Shingle, Slate & Sheathing Co., Ambler, Pa.
Barrett Co., The, New York City.
Beaver Products Co., Inc., Buffalo, N. Y.
Carter Bloxonend Flooring Co., Kansas City, Mo.
Celotex Co., The, Chicago.
Chicago Bridge & Iron Works, Chicago.
Cleveland Pneumatic Tool Co., The, Cleveland.
Cook, A. D., Inc., Lawrenceburg, Ind.
Detroit Graphite Company, Detroit.
Detroit Steel Products Co., Detroit.
Dickinson, Paul, Inc., Chicago.
Dixon, Joseph, Crucible Co., Jersey City, N. J.
Duff Mfg. Co., The, Pittsburgh.
Fairbanks, Morse & Co., Chicago.
Fairmont Railway Motors, Inc., Fairmont, Minn.
Hastings Signal & Equip. Co., Boston, Mass.
High Grade Mfg. Co., The, Cleveland, O.
Jenkins Bros., New York City.
Jennison-Wright Co., The, Toledo, O.
Johns-Manville Company, New York City.
Kaustine Co., Buffalo, N. Y.
Lehon Company, The, Chicago.
Massey Concrete Products Co., Chicago.

Murdock Mfg. & Supply Co., The, Cincinnati, O.
National Lead Company, New York City.
Nelson, Jos. E., & Sons, Chicago.
New Jersey Zinc Sales Co., New York City.
Norton, A. O., Inc., Chicago.
Patterson, W. W., Co., Pittsburgh, Pa.
Pocket List of Railroad Officials, The, New York City.
Railway Review, Chicago.
Redwood Manufacturers Co., San Francisco, Cal.
Robertson, Wm., & Co., Chicago.
Sherwin-Williams Co., The, Cleveland, O.
Simmons-Boardman Publishing Co., New York.
Snow, T. W., Construction Co., Chicago.
Templeton, Kenly & Co., Ltd., Chicago.
U. S. Wind Engine & Pump Co., Batavia, Ill.
Woolery Machine Co., Minneapolis, Minn.

Directory of Associations

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.—C. A. Lichty, secretary, 319 North Waller avenue, Chicago. Next convention, Buffalo, N. Y., October 20-22, 1925.

AMERICAN RAILWAY ENGINEERING ASSOCIATION (Works in co-operation with the American Railway Association, Division IV).—E. H. Fritch, secretary, 431 South Dearborn street, Chicago. Next convention, Congress Hotel, Chicago, March 9-11, 1926.

AMERICAN WOOD PRESERVERS' ASSOCIATION.—E. J. Stocking, secretary, 111 West Washington street, Chicago. Next convention January, 1926, Cleveland, Ohio.

BRIDGE AND BUILDING SUPPLY MEN'S ASSOCIATION.—B. J. Wilson, Pocket List of Railroad Officials, 605 Fischer Building, Chicago. Annual exhibit at convention of American Railway Bridge and Building Association.

NATIONAL ASSOCIATION OF RAILROAD TIE PRODUCERS.—J. S. Penney, secretary, T. J. Moss Tie Company, St. Louis, Mo. Next convention January, 1926, Cleveland, Ohio.

NATIONAL RAILWAY APPLIANCES ASSOCIATION.—C. W. Kelly, secretary, Seeberger Building, 825 South Wabash avenue, Chicago. Annual exhibition at convention of American Railway Engineering Association.

ROADMASTERS' AND MAINTENANCE OF WAY ASSOCIATION.—T. F. Donahoe, secretary, 428 Mansion street, Pittsburgh, Pa. Next convention at Chicago.

TRACK SUPPLY ASSOCIATION.—W. C. Kidd, Ramapo-Ajax Corporation, Hillburn, N. Y. Annual Exhibit at convention of Roadmasters' and Maintenance of Way Association.

Making a Slump Test to Determine the Consistency of Concrete

The Material Market

THE IRON and steel market at the present time may be said to be steady. After a considerable increase in business during August and the early part of September, the demand has shown a tendency to level off. Therefore, while the increased demand gave some impetus to the operations of the manufacturers it has not been enough to result in any accumulation of unfilled orders on their books. On the whole, therefore, the prices have remained substantially stationary, as will be noted in the table below.

PRICES PER 100 LB.

	Pittsburgh August	Chicago August	Pittsburgh September	Chicago September
Track spikes	$2.80 to $3.00	$2.90 to $3.00	$2.80 to $3.00	$2.80 to $3.00
Track bolts	3.90 to 4.25	3.90 to 4.00	3.90 to 4.25	3.90 to 4.00
Angle bars	2.75	2.75	2.75	2.75
Tie plates, steel	2.35 to 2.40	2.25 to 2.35	2.35 to 2.40	2.35 to 2.40
Boat spikes	3.25	3.25	3.25	3.25
Plain wire	2.50	2.55	2.50	2.55
Wire nails	2.65	2.70	2.65	2.75
Barb wire, galv.	3.35	3.40	3.35	3.40
C. I. pipe, 6 in. to 12 in., ton				49.20
Plates	1.80 to 1.90	2.10	1.80 to 1.90	2.10
Shapes	1.90 to 2.00	2.10	1.90	2.10
Bars, soft steel	1.90 to 2.00	2.10	2.00	2.10
Rivets, struct	2.40 to 2.50	2.50 to 2.60	2.40 to 2.50	2.60 to 2.65
Conc. bars, billet	1.90 to 2.00		1.90 to 2.00	
Conc. bars, rail		2.00		2.00
Rail, per gross ton, f.o.b. mill		43.00		43.00

Taken as a whole the scrap market is now at a low ebb, reports indicating that there is little demand. Thus far, however, this condition has not had the effect of producing any appreciable reductions in the prices of scrap items relating to track materials.

PRICES PER GROSS TON AT CHICAGO

	August	September
Relaying rails	$26.00 to $31.00	$26.00 to $31.00
Rails for re-rolling	19.00 to 19.50	19.00 to 19.50
Rails less than 3 ft. long	20.50 to 21.00	20.00 to 20.50
Frogs and switches cut apart	18.00 to 18.50	17.75 to 18.25
Steel angle bars	19.50 to 20.00	20.50 to 21.00

The average volume of unfilled orders on the books of Southern pine mills was larger on September 18 than at any time since February of this year. They were fully 25 per cent higher than they were at this time last year, and 10 per cent higher than for the corresponding period in 1923. As a consequence of this increase in demand there has been a moderate upward movement in prices, as indicated in the table below. Mills on the west coast also report a definite increase in the production, orders and shipments over the corresponding period of last year but this change has not been reflected by any notable difference in quotations on items commonly demanded by the railroads for bridge and building purposes.

SOUTHERN PINE MILL PRICES

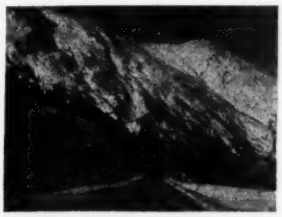
	Aug.	Sept.
Flooring, 1x4, B and B flat	$45.50	$47.11
Boards, 1x8, No. 1	34.85	34.47
Dimension, 2x4, 16, No. 1, common	27.25	28.58
Dimension, 2x10, 16, No. 1, common	28.41	32.20
Timbers, 4x4 to 8x8, No. 1	27.80	29.19
Timbers, 3x12 to 12x12, rough	28.61	34.65

DOUGLAS FIR MILL PRICES

Flooring, 1x4, No. 2, clear flat	$28.00	$27.00
Boards, 1x8, 6 to 20, No. 1, common	16.50	16.50
Dimension, 2x4, 16, No. 1, common	17.50	17.50
Dimension, 2x10, 16, No. 1, common	17.00	17.00
Timbers, 6x6 to 8x8, No. 1, common	21.00	21.00
Timbers, 10x10 to 12x12, rough	18.00	18.00

Prices for Portland cement remain unchanged. The following table gives prices per barrel in carload lots, not including package.

New York	$2.15	Minneapolis	$2.42
Pittsburgh	2.19	Dallas	2.05
New Orleans	2.40	Denver	2.84
Chicago	2.20	San Francisco	2.31
Cincinnati	2.47	Montreal	1.80



News of the Month

The Illinois Central expects to complete the electrification of its Chicago suburban service and have trains in operation under the new system six months ahead of the time, February 20, 1927, specified in the agreement between the railroad and the city.

The net railway operating income for Class I railroads in the United States for the first seven months of 1925 amounted to $537,165,541, which was at an annual rate of return of 4.53 per cent on the property investment, as compared with $466,718,335, or 4.06 per cent for the same period last year.

On September 2, the Chicago, Burlington & Quincy celebrated the 75th anniversary of the beginning of its operation of the 12-mile line from Aurora, Ill., to Turner Junction, now West Chicago, on which service was begun in September , 1850. This was the initial section of the Burlington.

President Coolidge is in favor of voluntary consolidation of the railroads and of such modifications of the Transportation Act as will enable the railroads to effect consolidation with greater facility than is now possible. Recent newspaper reports to the effect that President Coolidge favored compulsory consolidation are apparently without any foundation.

The total loss and damage for the first five months of 1925 as reported by the principal carriers of the United States to the Freight Claim division of the American Railway Association, totaled $17,093,665 as compared with $22,431,159 for the same period in 1924, a reduction of 23.8 per cent. For the month of May, 1925, the amount totaled $3,289,290, as compared with $4,282,299 in May, 1924, or a decrease of 23.2 per cent.

Serious question has been raised regarding the wisdom of the building of the Alaska Railway by the United States government, which cost $60,000,000 and serves a population of less than 5,000 people, while the cost of operation and maintenance is $2,000,000 a year, which is an average of $400 for every person served. Congressman Arthur M. Fee of California, who has just returned from Alaska, is of the opinion that the government should abandon this line and use the roadbed for a highway.

A cloudburst of unprecedented proportions in the drainage area of the Price river, Utah, did heavy damage to 18 miles of the main line of the Denver & Rio Grande Western between Woodside, Utah, and Verde, and also to the Sunnyside branch, north of Mounds, on August 27. Five steel bridges and three trestles, with a large amount of embankment ranging from 15 to 25 ft. in height, were washed out. Temporary repairs were completed and through service restored on Tuesday night, September 1.

Conscription of Santa Fe trackmen, to fight forest fires in the mountains in the vicinity of Pasadena, Cal., has been made the subject of a protest, sent to the Forestry Service, by the agent of the Atchison, Topeka & Santa Fe at Pasadena. This is expected to raise the issue of whether or not railroad employees should be exempt from such conscription. The Santa Fe agent in his protest characterized the action as "poor judgment" and said it imperiled the lives of 4,000 passengers who traveled over the lines that had been left entirely unprotected. Fifty men were conscripted by the government.

The Chicago, Milwaukee & St. Paul and the **Chicago, Rock Island & Pacific** have been granted an injunction by the Federal court at Minneapolis to prevent the enforcing of an ordinance to compel grade separation in the southern part of that city. This action has been the outcome of a matter which has been in litigation for many years, the controversy growing out of the fact that the city has insisted that grade separation must be carried out by track depression, whereas the railroads have contended that it would be effected much more economically by track elevation.

Hearings for an advance in wages of maintenance of way employees will be conducted by the United States Railroad Labor Board beginning October 1 in pursuance of ex-parte submissions for such advances made by the United Brotherhood of Maintenance of Way Employees and Railway Shop Laborers. Submissions on behalf of the employees of individual roads were filed by representatives of the brotherhood on each road during the past summer but the hearing was delayed until this time on account of the summer recess taken by the Labor board. The increase requested in the submissions is in most cases five cents per hour.

Progress in the installation of train control systems in accordance with the order of the Interstate Commerce Commission is indicated by a statement issued by W. J. Harahan, chairman of the Committee on Automatic Train Control of the American Railway Association. According to this statement, 5,044 miles, or 65 per cent of the total mileage of train control covered by the commission's order, was completely installed or in process of installation on August 1, 1925. Of the 45 railroads included in the order, 13 have completed permanent installations, 16 have permanent installations now under construction, 13 have completed preliminary installations, while 3 others have preliminary installations under construction.

The Atchison, Topeka & Santa Fe is preparing a formal protest against the valuation placed upon it by the Interstate Commerce Commission on account of large discrepancies in some of the most important points of the valuation compared with the company's figures. According to the commission's finding, $391,162,318 was the value of the property owned on June 30, 1916, and $476,120,978 was that of property used on that date. Discussing the commission's findings in an interview with newspapermen, President W. B. Storey, of the Santa Fe, said that in the nine years since 1916 the management has actually expended on the property $232,000,000. With this amount and with a fair allowance for the increases in prices since the date of the commission's figures, which it is believed should be made, the Santa Fe claims a true valuation today of approximately $1,000,000,000.

Hearings before the Interstate Commerce Commission on the application of the western railroads for a general increase in freight rates were opened in Chicago on September 8. According to a statement by C. E. Spens, vice-president of the Chicago, Burlington & Quincy, the railroads are asking for a horizontal increase of five per cent with exceptions on certain commodities with respect to which they are requesting increases of one to two cents per 100 lb., and 7½ cents and 15 cents per ton between certain basic points regardless of the distance. A large amount of testimony has been presented to show the necessity for this increase. The present level of western freight rates is only 29 per cent higher than in 1911, whereas the prices of all commodities, wages and taxes have increased far more than that proportion in the same period. It was also shown that whereas an increase of approximately five per cent is all that is asked for, it would require an increase of at least 11 per cent to yield the roads the fair return on their investment fixed by the Interstate Commerce Commission.

Personal Mention

General

The headquarters of the operating department of the Seaboard Air Line will be transferred from Norfolk, Va., to Savannah, Ga., on October 1. Officers affected by the change include the vice-president in charge of operation, the chief engineer and the engineer maintenance of way.

Engineering

C. H. R. Howe has been appointed cost engineer, maintenance of way department, of the Chesapeake & Ohio, with headquarters at Richmond, Va.

Arthur O. Ridgway, chief engineer of the Denver & Rio Grande Western, with headquarters at Denver, Colo., has been appointed also chief engineer of the Denver Union Terminal Company.

A. W. White has been appointed assistant division engineer of the Big Sandy division of the Norfolk & Western, this division having been increased in size by the amalgamation with it of the Sandy Valley & Elkhorn Railway.

F. J. Bishop, assistant engineer of the Ann Arbor, with headquarters at Owosso, Mich., has been appointed acting chief engineer, with the same headquarters, effective August 1, during the illness of **L. J. Allen,** chief engineer.

George Lewis, general manager of construction for the Moffat Tunnel Commission, Denver, Colo., has been promoted to chief engineer, succeeding **R. H. Keays,** who has been appointed chief engineer of the Marathon Water Supply Project for Athens, Greece. The Marathon Water Supply Project will cost $11,000,000 and will require four years for its completion.

C. S. Colvin, whose promotion to division engineer of the Louisiana division of the Gulf Coast Lines, with headquarters at DeQuincy, La., was reported in the August issue, was born on July 10, 1891, at Kansas City, Mo. He was employed as a rodman for the U. S. Boundary Commission in 1909 and 1910, and in the same capacity for the American Land & Irrigation Company from 1910 to 1913. He served as an instrumentman for the Denver Reservoir & Irrigation Company at Denver, Colo., from 1913 to 1914, in the latter year becoming geologist's assistant for the Producers Oil Company. He entered railway service in 1915 and from that date until 1917 served consecutively as rodman, instrumentman and assistant engineer on the New Orleans, Texas & Mexico, a part of the Gulf Coast Lines. From 1917 to 1919 he served in the U. S. Army Engineers Corps, after which he returned to the Gulf Coast Lines as an assistant engineer. He was employed on the Houston Belt & Terminal railway in 1920, returning to the Gulf Coast Lines in 1921 as an assistant engineer, which position he held at the time of his promotion to division engineer.

W. E. Heimerdinger, assistant engineer on the Chicago, Rock Island & Pacific, with headquarters at Des Moines, Iowa, has been promoted to division engineer at Cedar Rapids, Iowa, succeeding **Garrett Davis,** who has been retired after reaching the age limit of the road. Mr. Davis was born on August 19, 1855, in Scott county, Ky., and in 1874 entered the construction department of the Southern Pacific, where he remained until 1877, when he left that road to engage in the same character of work on the Burlington, Cedar Rapids & Northern, now a part of the Chicago, Rock Island & Pacific. From 1878 to 1894 he served as a roadmaster, in the latter year being promoted to division engineer. In 1900 he was made assistant chief engineer and in 1902, when this road was taken over by the Chicago, Rock Island & Pacific, became district engineer. In 1907 he was promoted to division superintendent, which position he held until 1914, at which time he became division engineer. From 1916 to 1920 he served in various capacities on valuation surveys and construction work, in the latter year becoming division engineer, which position he was holding at the time of his retirement from active service.

Track

Charles Johnson, extra gang foreman on the Calgary division of the Canadian Pacific, has been appointed roadmaster on the Lethbridge division.

C. Pickering has been appointed acting roadmaster on the Ann Arbor, with headquarters at Cadillac, Mich., succeeding **Martin Emfield,** who was killed while on duty on July 29, 1925.

H. G. Snyder, assistant engineer on the New York Central, Ohio Central lines, at Bucyrus, Ohio, has been appointed supervisor, with headquarters at Hobson, Ohio, succeeding **W. A. Marshall,** resigned.

H. H. Notley has been appointed roadmaster of the Marysville district of the Sacramento division of the Southern Pacific, with headquarters at Marysville, Cal., succeeding **E. E. Earl,** who has been transferred to the Los Angeles Terminal district, with headquarters at Los Angeles, Cal., succeeding **J. C. E. McClure,** resigned.

John J. Dwyer, whose promotion to roadmaster on the Chicago & North Western at Escanaba, Mich., was reported in the September issue, was born on February 18, 1876, at Brampton, Mich., and entered the service of the Chicago & North Western as a section laborer at Brampton on August 18, 1890. He was promoted to section foreman on April 1, 1898, and was promoted to yard foreman of the Negaunee yard on June 1, 1908. On May 1, 1913, he became general foreman of the Escanaba yard, which position he held until July 15, 1924, when he was promoted to assistant roadmaster at Escanaba, which position he was holding at the time of his promotion to roadmaster.

F. S. McNutt, who was promoted to inspector of track and roadway on the Coast Lines of the Atchison, Topeka & Santa Fe, with headquarters at Los Angeles, Cal., as announced in the September issue, was born at Hull, Ill., on August 22, 1876, and entered railway service on April 4, 1901. From that date until October 1, 1906, he served consecutively as section, yard and extra gang foreman on the Atchison, Topeka & Santa Fe at Winslow, Ariz. From October 1, 1906, to July 1, 1922, he was roadmaster on various districts of the Albuquerque division, on the latter date being transferred to Los Angeles, where he was serving at the time of his promotion to inspector of track and roadway.

J. F. Talbot, whose promotion to supervisor of track on the Boston & Maine, with headquarters at Boston, Mass., was reported in the August issue, was born on January 29, 1885, at Salem, Mass. During his school vacations in 1900 and 1901 he served as a trackman on the Southern division of the Boston & Maine, becoming a permanent employee of that road in the same capacity in June, 1902. He was appointed division storekeeper of track material in January, 1905, and from 1912 to 1916 served as an extra gang foreman, on the latter date being appointed assistant track supervisor, which position he was holding at the time of his promotion to supervisor of track.

A. G. Hart, roadmaster on the Southern Pacific, with headquarters at San Vallejo, Cal., has retired after many years of active service. He was born in New York state on May 3, 1855, and was employed on the New York Central from 1870 until 1875, when he went out west. In 1877 he joined an engineering corps of the Southern Pacific, and was employed on the construction of the line from Yuma, Ariz., to San Antonio, Tex. On the completion of the line in November, 1882, he was transferred to the western division where he served as assistant division engineer until January, 1883, at which time he was transferred to the Salt Lake division as roadmaster, where he remained until April 30, 1895. From June 1, to September, 1896, he served as roadmaster on the San Joaquin division, on the latter date being appointed as section foreman on the Sacramento division. In September, 1901, he again became roadmaster, with headquarters at Redding, Cal., where he served until October, 1919, when he was transferred to the Western division at San Vallejo, where he was employed at the time of his retirement, after serving 46 years 8 months with the Southern Pacific.

H. L. Barr, whose promotion to roadmaster on the Chicago & North Western, at Lusk, Wyo., was reported in the

September issue, was born on December 28, 1897, at Defiance, Ohio. He attended the Defiance College for two years, in 1917 entering railway service as a work train foreman and material clerk on double track work on the Baltimore & Ohio. In 1918 and 1919 he served as assistant supervisor of track at Hamden, Ohio, in the latter year leaving this road to become a rodman on the Chicago & North Western, later being promoted to instrument man. In 1923 he was made assistant engineer in charge of yard and enginehouse construction at Casper, Wyo., again serving as instrument man in 1924, which position he was holding at the time of his recent promotion.

P. J. McCarthy, whose promotion to roadmaster on the Kansas City Southern, with headquarters at Shreveport, La., was reported in the August issue, was born on July 13, 1879, at Wilbur, Neb., and graduated from Kansas State University in 1902. He entered railway service in May, 1901, as a rodman on the St. Louis-Kansas City & Colorado, now a part of the Chicago, Rock Island & Pacific, where he served consecutively as masonry inspector and resident engineer until August, 1904. Following this date he was employed in engineering work for railroads and contractors in various parts of the country, again entering the service of the Kansas City Southern on June, 1922, as a masonry inspector, being promoted to assistant engineer, a position he was holding at the time of his recent promotion.

James B. Warren, whose promotion to roadmaster on the Atchison, Topeka & Santa Fe, with headquarters at Dalies, N. M., was reported in the September issue, was born on January 11, 1883, at Detroit, Ala., and attended the School of Agriculture at Hamilton, Ala. He entered railway service on the Northern division of the Santa Fe as a laborer at Byars, Okla., in January, 1910, and was transferred to the Rio Grande division at San Marcial, N. M., in October, 1910. From November 1, 1910, to June 8, 1913, he was employed as yard and extra gang foreman, later being transferred to the Coast lines at Albuquerque, N. M. He was appointed section foreman on June 8, 1922, which position he held until December 18 of the same year when he was promoted to acting roadmaster, holding this position until October 31, 1924. He again served as section foreman from November 1 to August 9, 1925, which position he was holding at the time of his promotion to roadmaster on the Albuquerque division.

Bridge and Building

E. R. Tattershall, whose promotion to supervisor of piers and buildings of the New York Central, with headquarters at New York City, was reported in the September issue, was born on August 25, 1882, at White Haven, Pa., and graduated in 1906 from Lehigh University. He entered railway service as a rodman on the Pennsylvania division of the New York Central on June 20, 1906, on June 18, 1907, being made transitman on the River division at Weehawken, N. J. From August 10, 1908, until November 5, 1912, he served as an assistant supervisor of bridges and buildings, on the latter date being promoted to supervisor of bridges and buildings on the Adirondack division at Malone, N. Y. He was holding this position at the time of his promotion to supervisor of piers and buildings.

Kemper Peabody, whose promotion to general supervisor of buildings of the New York Central, with headquarters at New York City, was reported in the September issue, was born on August 2, 1861, at Plymouth, Wis., and attended the Shattuck Military School from 1881 to 1882. He entered railway service in 1887 on the Duluth & Iron Range, where he remained for one year, serving as a chainman, rodman, transitman and inspector, respectively. He became a masonry inspector on the Chicago Great Western in 1897, holding this position until 1901 when he left that road to serve as a building inspector on the New York Central. From 1902 until 1909 he was general foreman of buildings, in the latter year becoming assistant supervisor of buildings, which position he held until 1919 when he was promoted to supervisor of piers and buildings. He was holding this position at the time of his recent promotion.

George M. Haley, whose promotion to supervisor of bridges and buildings of the Union Pacific was reported in the July issue, was born on December 25, 1889, at Laclede, Mo., and entered railway service in 1913 as a bridge and building helper on the Salt Lake division of the Union Pacific, later in the year being promoted to bridge and building carpenter. In 1914 he served as assistant foreman and later as acting foreman of the maintenance of way division shops and material yards at Lynndyl, Utah. In 1916 he was promoted to foreman of these shops and yards, which position he held until 1919, when he was made assistant supervisor of bridges and buildings on the Salt Lake division. He was transferred to the Los Angeles division as general foreman of water service in September, 1923, and again appointed assistant supervisor of bridges and buildings on November 1, 1923, which position he was holding at the time of his promotion to supervisor of bridges and buildings.

George D. Fullick, whose promotion to supervisor of bridges and buildings on the Southern Pacific, Texas and Louisiana lines, with headquarters at Victoria, Tex., was reported in the July issue, entered railway service in February, 1885, as a bridge and building helper on the Houston division of the Galveston, Harrisburg & San Antonio. From 1888 to 1892 he served as a bridge and building carpenter on the same division, in the latter year becoming assistant bridge and buildiing foreman, which position he held until October 1, 1894, when he was compelled to leave railway service because of ill health. He returned to the same road as assistant and extra bridge and building foreman on June 1, 1898, and was transferred to the North Victoria division as assistant bridge and building foreman on November 1, 1898. From March 1, 1904, to July 1, 1922, he served as bridge and building foreman, being promoted on the latter date to general foreman of ballast gangs, a position he held until May 1, 1924, when he was made bridge and building foreman, which position he was holding at the time of his recent promotion to supervisor of bridges and buildings.

Purchasing and Stores

C. L. Tiller has been appointed division storekeeper of the Southern, with headquarters at South Richmond, Va., succeeding **W. N. Pollard,** deceased.

O. A. Donegan has been appointed general storekeeper of the Boston & Maine, with headquarters at Boston, Mass., succeeding J. E. Byron, who has been assigned to other duties. Mr. Donegan's appointment is effective on October 1.

Obituary

Carl E. Gosline, track engineer of the Delaware, Lackawanna & Western, with headquarters at Hoboken, N. J., died on September 28.

James Wilson, division engineer of the Chicago, Milwaukee & St. Paul, with headquarters at Seattle, Wash., died on August 17. He was born in 1852, and entered railway service in 1875 on the Chicago, Burlington & Quincy, serving as transitman and resident engineer. From 1880 to 1882 he acted as a locating and as a division engineer for the Wabash, in the latter year becoming timber agent for the Iowa Central. In 1886 he entered the service of the Chicago, Milwaukee & St. Paul, from that date until 1888 serving as transitman and resident engineer on the Kansas City extension of that line, when he became construction engineer for the Minneapolis, St. Paul & Sault Ste Marie. From 1892 to 1903 he served as resident and locating engineer for the Burlington, taking charge of river improvements for the city of Des Moines, Iowa, in 1904 and remaining there until 1905, when he returned to the Chicago, Milwaukee & St. Paul. He held various positions in the engineering department, having charge of preliminary location and construction of the main line west of the summit of the Cascade mountains, including the terminals at Seattle and Tacoma. At the conclusion of this work he was promoted to assistant engineer with headquarters at Seattle, later being appointed division engineer, the position he held at the time of his death.

Construction News

The Alabama, Tennessee & Northern has filed a petition with the Interstate Commerce Commission asking permission to construct an extension of its line from its present northern terminus, Reform, Ala., connecting with and crossing the St. Louis-San Francisco at Bazemore or Glen Allen, Ala., to Haleyville, Ala., where it would connect with the Illinois Central and the Northern of Alabama. The distance from Reform to the Frisco would be 52 miles, and 26 miles further to the Illinois Central.

The Atchison, Topeka & Santa Fe has awarded a contract to the Sumner Sollitt Company, Los Angeles, Cal., for the construction of a passenger station at Monrovia, Cal., to cost $75,000, as reported in the September issue.

The Atlantic Coast Line has been authorized by the Interstate Commerce Commission to construct an extension southward from its southern terminus at Immokalee, Fla., to Deep Lake, a distance of approximately 27 miles; estimated construction cost, $620,347. The work must be commenced by January 1 and completed during 1926.

The Baltimore & Ohio has awarded a contract to the Vang Construction Company, Cumberland, Md., for grading and bridges for a new main track from Warwick, Ohio, to Sterling (11.5 miles) at an approximate cost of $70,000. A contract has been awarded to the T. J. Foley Construction Company, Pittsburgh, Pa., for the elimination of grade crossings at Allison Park, Pa., and Elfinwild at an approximate cost of $39,000.

A contract has also been awarded to the Empire Engineering Company, Baltimore, Md., for the reconstruction and extension of the arch of a bridge over Big Walnut creek, Big Walnut, Ohio. The work will cost approximately $100,000.

The Boston & Maine has awarded a contract for the construction of a seven-story office building in East Cambridge, Mass., to the Scully Company, Cambridge, Mass. The cost is estimated at $260,000. It was incorrectly reported in the September issue that the Boston & Albany was planning this structure. A contract for the rebuilding of a bridge at Fitchburg, Mass., let to the Boston Bridge Works and another awarded to the T. Stuart & Son Company for foundations for the new office building at East Cambridge were likewise erroneously ascribed to the Boston & Albany.

The Canadian National is constructing a 30-mile branch line from Warden, Alta., eastward. The contract has been awarded to R. W. Graham, Edmonton, Alberta.

The Central of New Jersey has awarded a contract to the Jobson-Gifford Company for the construction of a concrete bridge in Elizabeth, N. J., in connection with the company's reconstruction of its bridge over Newark bay.

The Chesapeake & Ohio has awarded a contract to Milo R. Hanke, Cincinnati, O., for the erection of a new boiler shop at Huntington, W. Va. The building will be of steel and brick construction with a cement tile roof and a wood block floor, 140 ft. by 404 ft. The total cost of the project is estimated at $575,000. The construction of approximately 10 miles of second track between Waverly, Ohio, and Portsmouth has been authorized.

The Chicago, Burlington & Quincy has authorized construction on the following buildings and improvements: storehouse at Aurora, Ill., $42,000; pattern storage building at Burlington, Ia., $60,000; elevator annex at Murray, Mo., $450,000; reconstruction of the bridge over the Elkhorn river at Winslow, Neb., with two 132-ft. through truss spans and two 72-ft. deck plate girder spans on concrete piers, $51,000; replacement of pile trestle bridge over Loup river at Ravenna, Neb., with steel and concrete structure and better grades, $45,000; replacement of eight 80-ft. deck plate girder spans with six 100-ft. deck plate girder spans on concrete piers at Woodcliffe, Neb., $182,000; new steel bridge 240 ft. long on concrete piers at Western avenue, Chicago, $175,000; water treating plants at Buda, Ill., Quincy and Beardstown and Sheridan, Wyo., $80,000; changes in the Fourteenth street passenger yard at Chicago, $60,000; industrial track changes at Peoria, Ill., $93,000; spur track at Tampa, Col., $176,000.

The Cleveland Union Terminal has prepared plans for the construction of a two-span structural steel and concrete bridge over the Cuyahoga river, Cleveland, Ohio, to cost $200,000.

The Florida East Coast has awarded a contract to the Donahoo Construction Company, Jacksonville, Fla., for second track construction between Boca Raton, Florida, and Colohatchee.

The Illinois Central closed bids on September 1 for the construction of the superstructures of the buildings in the locomotive and car repair terminal at Paducah, Ky.

The Indiana Harbor Belt has awarded a contract to the Public Construction Company for the construction of a pumping plant and reservoir at Belmont avenue (Chicago) reported in the August issue.

The Jefferson & Northwestern's nine-mile extension from Marietta, Tex., which has been authorized by the Interstate Commerce Commission, will be constructed by company forces at a cost estimated at $75,000.

The Kentucky & Indiana Terminal has received bids for the construction of a shop building, a storehouse and an office building at Louisville, Ky., to cost a total of $75,000.

The Louisville & Nashville has awarded a contract for the construction of 22 miles of second track between Winchester, Ky., and Richmond.

The Mississippi & Schoona Valley has been authorized by the Interstate Commerce Commission to construct a line from a connection with the Illinois Central at Bryant, Miss., to Bruce, 22 miles, at an estimated cost of $138,816. Rails and cars will be leased to the company by the Illinois Central.

The New York Central is reported to have awarded a contract to H. K. Ferguson Company, Toledo, Ohio, for the construction of a 60-ft. by 80-ft. machine shop at AirLine Junction, near Toledo, Ohio.

The New York State Transit Commission has issued an order calling for the beginning of work on the removal of grade crossings on the line which lies along the west side of the Manhattan Island, New York City; nine crossings in a space of about 1½ miles.

The New York, New Haven & Hartford has awarded a contract to the Curtis-Quillen Company for the construction of concrete driveways in its bulk delivery facilities at Providence, R. I., at an approximate cost of $45,000.

The North & South will undertake the extension of the present line from Casper, Wyo., to Miles City, Mont., in accordance with the original plans, if the necessary financing can be arranged. It is understood that legal obstructions to the construction of this extension have been removed by the purchase by Peterson, Shirley & Gunther, general contractors in the building of the railway, of all equities, claims, etc., of the Middle States Oil Company and the Reliable Securities Corporation.

The Northern Pacific is completing plans for the construction of a 50-mile branch line from Orofino, Idaho, into the Clearwater timber district in northern Idaho. The line will be constructed jointly by the Northern Pacific and the Oregon Washington Railroad & Navigation Company.

The Oregon Trunk has completed plans for the construction of an extension from Bend, Ore., to Klamath Falls, a distance of 170 miles. If authorization for the construction is secured from the Interstate Commerce Commission it is planned to begin work early next spring.

The Pennsylvania has awarded a contract for the reconstruction of an undergrade bridge at Lee street, Portage, Pa., to the John F. Casey Company, Pittsburgh, Pa. The approximate cost is $100,000.

A contract has been awarded to the T. J. Foley Company, Pittsburgh, Pa., for the reconstruction of an undergrade highway bridge at Weirton, W. Va., made necessary by the widening of the highway at an approximate cost of $35,000. Contracts have been awarded to the H. E. Wagner Company,

Harrisburg, Pa., and the Milliron Construction Company, Du Bois, Pa., respectively for masonry for undergrade bridges at Duboistown, Pa., and Troy, Pa., each of which involves an expenditure of approximately $25,000.

This company has also awarded a contract for the construction of its new West Philadelphia, Pa., office building to Irwin & Leighton, Philadelphia. The building will have a frontage of 150 ft. and a depth of 250 ft. Construction will be of steel, with brick walls and stone and terra cotta trim.

The Reading plans to increase its terminal facilities at Port Richmond, Philadelphia, Pa., by the erection of a new grain elevator of 2,500,000 bu. capacity. The cost will be approximately $3,500,000.

The Rouyn Mines have reached an agreement with the Canadian National, after negotiations covering many months, whereby the Rouyn Mines Railway Company will construct a line from O'Brien, on the main line of the National Transcontinental Railway, south about 50 miles to Rouyn in the heart of the new gold fields in northwestern Quebec.

The St. Louis-San Francisco has a survey party in the field making preliminary surveys for the connection between the Muscle Shoals, Birmingham & Pensacola, recently purchased by the St. Louis-San Francisco, with the Frisco main line in the vicinity of Birmingham, Ala. The distance between the two lines is approximately 150 miles.

This road has awarded a contract to the Pauly Construction Company, Springfield, Mo., for the construction of a brick and concrete one-story mail, baggage and express building at Springfield, to cost $20,000. The passenger facilities and yards at Springfield, Mo., will be improved and enlarged at a cost of approximately $300,000.

The Southern Pacific has awarded a contract to the Ogle Construction Company, Chicago, for the construction of coaling stations at Tucson, Ariz., Deming, N. M., and Lordsburg, Bowie, Ariz., San Simon, Globe and Geronimo.

A contract has been awarded to the Standard Construction Company for the construction of a passenger station at Yuma, Ariz., to cost approximately $60,000.

Plans are being prepared for the construction of a terminal at Klamath Falls, Ore., and for the construction of a roundhouse at Santa Barbara, Cal., to replace the building which was destroyed by the earthquake several months ago. The new roundhouse will be in mission style with stucco exterior and a red tile roof.

Location surveys for the extension of the Oregon, California & Eastern from Sprague river, Ore., east to a connection with the Nevada-California-Oregon at Lakeview have been completed. This extension in conjunction with the Southern Pacific Natron cut-off will provide a new route from Oregon to the east, approximately 200 miles shorter than any present route.

This company will soon request bids for grading and structures in connection with the change of line on the main line of the Galveston, Harrisburg & San Antonio, between Langtry, Tex., and Osman. The new line will be 9.36 miles in length, replacing 13.84 miles of the present track. The cost of the entire work, including track, station buildings, water and fuel oil facilities and signals, is estimated at approximately $1,000,000.

The Texas & Pacific has awarded a contract to V. E. Ware, El Paso, Tex., for the construction of the superstructures of a roundhouse, a machine shop, and other terminal facilities at Shreveport, La. As reported in the March issue the Shreveport project will cost $925,000.

The Virginian has awarded a contract to the Roberts & Schaefer Company, Chicago, for the construction of a fireproof sand handling plant at Mullens, W. Va.

The Union Pacific has made an agreement with the city of Denver, Colo., for the construction of a subway under its tracks at 38th street. The estimated cost of $200,000 will be divided 70 per cent to the railroad and 30 per cent to the city.

The Wabash has awarded a contract to a local contractor for the construction of a roundhouse and service building at North Kansas City, Mo., to cost $100,000, as reported in the September issue.

Supply Trade News

General

Fairbanks, Morse & Co., Chicago, plan the construction of a one-story addition to their plant at Indianapolis, Ind.

The National Lock Washer Company has moved its Chicago offices from 1535 Lytton building to 1103 Straus building.

The Barber Asphalt Company has moved its Philadelphia offices from the Land Title building to 1600 Arch street, Philadelphia, Pa.

The National Lumber & Creosoting Company, Texarkana, Tex., is planning the construction of a tie treating plant at Salida, Colo., to treat ties and other timber for the Denver & Rio Grande Western.

The Chipman Chemical Engineering Company, Inc., has removed its executive and sales offices to its factory at Bound Brook, N. J. A branch office will be maintained at 136 Liberty street, New York City.

Plans for the consolidation of the **Keystone Steel & Wire Company,** Peoria, Ill., and the **Kokomo Steel & Wire Company,** Kokomo, Ind., have been submitted to the stockholders of the two companies for approval.

The Independent Pneumatic Tool Company, manufacturers of Thor pneumatic tools and electric tools, has opened a branch office at Milwaukee, Wis., in charge of **G. H. Du Sell,** who has represented the company in this territory for a number of years. The new office will be located at 288 East Water street.

The Inland Steel Company will spend $2,000,000 on additions and improvements to its Indiana Harbor, Ind., plant. Tentative plans have been drawn up providing for the electrification of one entire section of the plant and the addition of 77 coke ovens. In addition, the company is constructing its fourth blast furnace which will be completed by the first of the year.

The American Cable Company, New York, has appointed **Bruntons Musselburgh,** Scotland, its representative in Scotland, the **Dominion Wire Rope Company,** Montreal, Quebec, in Canada the **Marion Machine Foundry & Supply Company,** in Marion, Indiana, **J. Shuman Hower,** in Utica, N. Y., the **Contractors Equipment Company,** in Albany N. Y. and **John C. Louis,** in Baltimore, Md.

The Air Reduction Sales Company, New York, has created a new sales district, with office at 1296 Forest Home avenue, Milwaukee, Wis., following the purchase of the carbide business of the Gas Tank Recharging Company, of Milwaukee, Wis., including the acetylene plants at Milwaukee and Bettendorf, Ia., and a carbide plant at Keokuk, Ia. The new office will be in charge of **J. S. Strate,** district manager. The new district territory comprises parts of Wisconsin, Michigan, Illinois and Iowa.

On August 4, 1925, Judge Augustus N. Hand of the United States District Court of the Southern district of New York granted an interlocutory decree in which claims 2, 4, 6, 17, 21, 22, 28, 34 and 35 of United States Letter Patent No. 1127,660 granted to John H. MacMichael on February 9, 1915, were held valid. This decree was rendered in a suit brought by the **Concrete Mixing and Conveying Company,** Chicago, against the Ulen Contracting Corporation and the Shandaken Tunnel Corporation, for infringement of the MacMichael patent covering the method of elevating and transporting concrete by means of compressed air. The decree upholds all of the claims made by the complainant against the defendant.

Personal

E. B. Harkness, secretary of the Illinois Steel Company, has also been appointed secretary of the **Universal Portland Cement Company,** Chicago. **A. W. Carlisle,** treasurer of the Illinois Steel Company, has been appointed treasurer of the Universal Portland Cement Company. **O. N. Lindahl** has

been appointed assistant secretary, which position he will occupy in addition to the office of auditor.

Eugene H. Heald, assistant western division contracting manager of the **American Bridge Company,** with headquarters in Chicago, has been promoted to western division contracting manager, to succeed **Francis J. Llewellyn,** deceased.

J. R. Wilks, chief engineer of the **Armco, Culvert & Flume Manufacturers Association,** with headquarters at Middletown, Ohio, has been appointed manager of the **Ingot Iron Railway Products Company,** Chicago, to succeed **T. P. Kahoe,** resigned.

Carl S. Jordan, who has been serving as assistant to the manager of railroad sales of the **Wyoming Shovel Works,** has been transferred to San Francisco, Cal., where he will have charge of the California territory as district sales manager. He will be succeeded by **M. S. Hendrickson,** who will be located at the Chicago office of the Wyoming Shovel Works.

Perry T. Ford, formerly associated with **A. R. Taylor** as a representative of the **Ohio Valley Rock Asphalt Company** in Ohio, has been appointed sales manager for this company. The general sales offices of this company have been moved from 910-914 Schmidt building, Cincinnati, Ohio, to 517-518 Starks building, Louisville, Ky.

Milburn Moore, eastern engineering editor of the *Railway Age* and associate editor of *Railway Engineering and Maintenance,* has resigned to become district sales manager of the **Verona Tool Works,** with headquarters at 50 Church street, New York, to succeed **W. W. Glosser,** promoted to general sales manager, with headquarters at Pittsburgh, Pa. Mr. Moore entered the Armour Institute of Technology in 1905, taking a three-year course in the Scientific Academy and then a four-year course in mechanical engineering with extra work in the civil engineering department. After graduation he entered the service of the United States land department as a chainman, being later advanced to instrumentman on original survey work in the state of Montana. Returning to Chicago upon the completion of this work, he was employed as a salesman for an automobile specialties company until 1913, when he joined the engineering staff of the Chicago, Milwaukee & St. Paul, serving as rodman and instrumentman and acting resident engineer both in maintenance and new construction work. In December, 1914, he went to Florida to assist in developing an orange and grape fruit grove, in addition to maintaining a small automobile and marine engine repair shop. In June, 1917, he enlisted in motor truck service of the United States army and was sent overseas as a truck despatcher in active service at the front. After being mustered out of service in 1919, he became a salesman in the industrial department of the Peoples Gas Light and Coke Company, Chicago, until October, when he became connected with the Simmons-Boardman Publishing Company as an associate editor. In April, 1920, he was made eastern engineering editor of the *Railway Age* and of *Railway Engineering and Maintenance.*

Milburn Moore

John T. Llewellyn, vice-president of the **Chicago Malleable Castings Company** and president of the Allied Steel Castings Company, Chicago, has been elected president of the Chicago Malleable Castings Company, to succeed Silas J. Llewellyn, who died on September 3 after an extended illness. James S. Llewellyn, secretary of the Chicago Malleable Castings Company, and secretary and works manager of the Allied Steel Castings Company, has been elected vice-president, general manager and secretary of the Chicago Malleable Castings Company, and vice-president, general manager and secretary of the Allied Steel Castings Company. Paul Llewellyn, treasurer of the Chicago Malleable Castings Company and vice-president of the Interstate Iron & Stel Company, has been elected vice-president and treasurer of the Chicago Malleable Castings Company and president of the Interstate Iron & Steel Company.

John T. Llewellyn was born in Briton Ferry, Wales, and came to America in 1864. He was educated in the public schools of Cleveland, Ohio, and Chicago, and in 1880 he entered the employ of the Illinois Steel Company as a telephone operator. In 1896 he organized the Valve Setting Company, Racine, Wis., and in 1898 he organized the Chicago Malleable Castings Company, of which he has since been vice-president and general manager. James S. Llewellyn was born in 1887 in Milwaukee and was graduated from the University of Michigan in 1908. After leaving school he entered the employ of the Chicago Malleable Castings Company and worked in the shops, occupying several positions until 1915 when he was appointed secretary, which position he has held until his recent promotion. Paul Llewellyn was born in 1886 and was educated at Yale University. In 1908 he entered the employ of the Interstate Iron & Steel Company, since which he has been manager of the East Chicago works, sales manager, vice-president of the latter company and treasurer of the Chicago Malleable Castings Company.

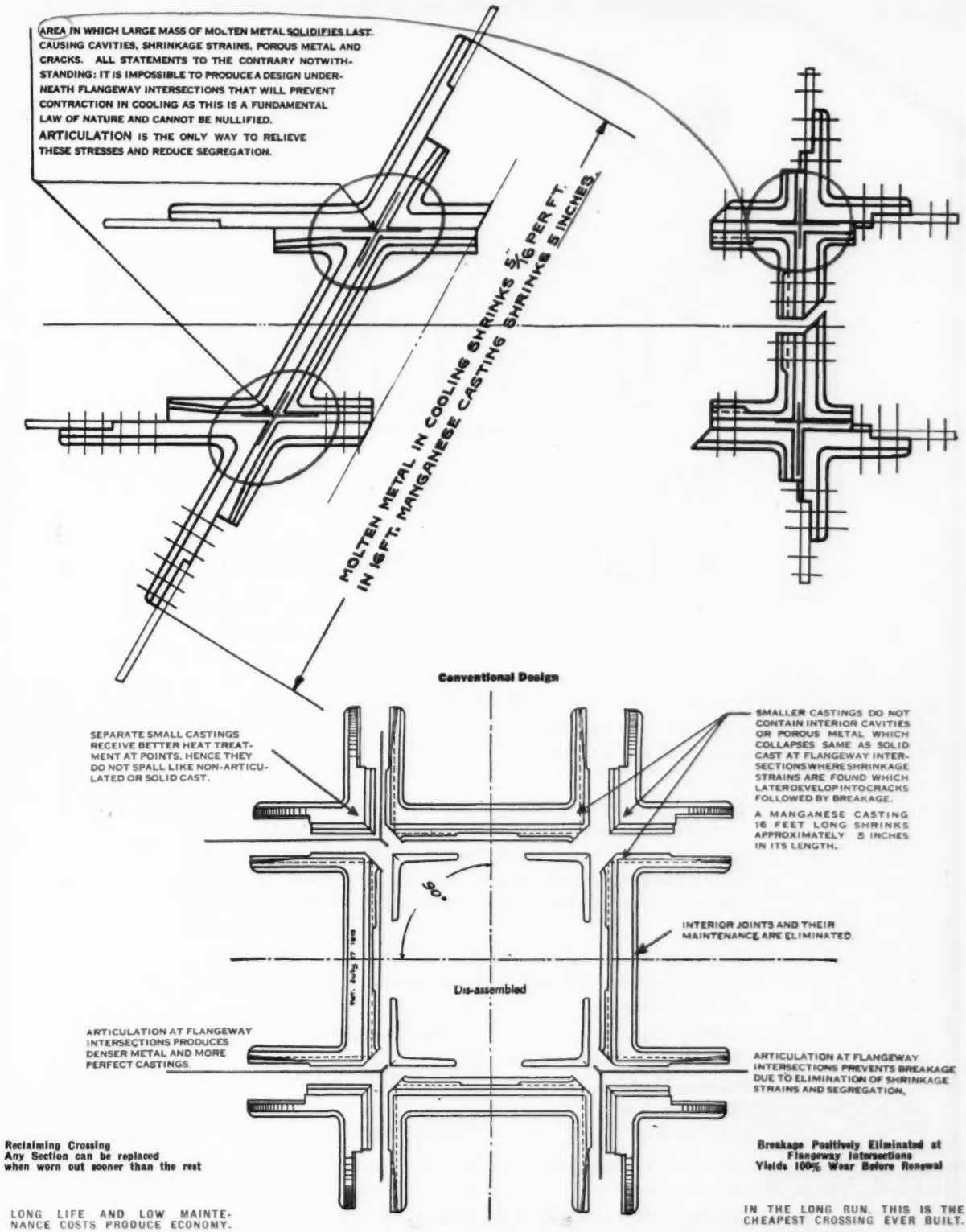
L. M. Zimmer has been appointed general sales manager of the **Linde Air Products Company,** manufacturers of oxygen, and of the welding gas division of the Prest-O-Lite Company, Inc., manufacturers of dissolved acetylene, succeeding L. M. Moyer, resigned. Mr. Zimmer entered the employ of the Linde Company nine years ago as junior salesman. Most of the time he has been in the Central West, going to New York early in 1924 to act as assistant general sales manager.

William S. Miller has been appointed manager of the newly formed railway equipment department of the Parsons Company, with headquarters in Newton, Ia. He was born in San Francisco, Cal., on May 17, 1888, and graduated from Leland Stanford University with the degree of civil engineer in 1911. Upon leaving school he entered the employ of Stone & Webster as a rodman and instrumentman on hydro-electrical construction in Washington. From 1912 to 1917 he was employed by the Senn-Smith Company, Los Angeles, Cal., manufacturers of mining equipment, as manager. In the latter year he was appointed eastern sales manager for the Lakewood Engineering Company, Cleveland, Ohio. Later he became central division manager of the George W. Goethals Company, Cleveland, which position he left in 1923 to undertake special engineering investigations. On April 1, 1925, he entered the employ of the Parsons Company, where he is in charge of the sale of their cast steel wheels for railway motor cars and the Woolery weed burner.

William S. Miller

Trade Publications

Unit Wall Construction.—The Federal Cement Tile Company has issued a four page folder illustrating and describing the Federal concrete cribbing, which comprises precast concrete units for the construction of retaining walls. Various illustrations show the manner of erecting the wall and present comparisons of the relative ease with which this wall is constructed, as compared with other forms of retaining walls.


AREA IN WHICH LARGE MASS OF MOLTEN METAL SOLIDIFIES LAST. CAUSING CAVITIES, SHRINKAGE STRAINS, POROUS METAL AND CRACKS. ALL STATEMENTS TO THE CONTRARY NOTWITHSTANDING: IT IS IMPOSSIBLE TO PRODUCE A DESIGN UNDERNEATH FLANGEWAY INTERSECTIONS THAT WILL PREVENT CONTRACTION IN COOLING AS THIS IS A FUNDAMENTAL LAW OF NATURE AND CANNOT BE NULLIFIED.
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SMALLER CASTINGS DO NOT CONTAIN INTERIOR CAVITIES OR POROUS METAL WHICH COLLAPSES SAME AS SOLID CAST AT FLANGEWAY INTERSECTIONS WHERE SHRINKAGE STRAINS ARE FOUND WHICH LATER DEVELOP INTO CRACKS FOLLOWED BY BREAKAGE.
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ARTICULATION AT FLANGEWAY INTERSECTIONS PREVENTS BREAKAGE DUE TO ELIMINATION OF SHRINKAGE STRAINS AND SEGREGATION.
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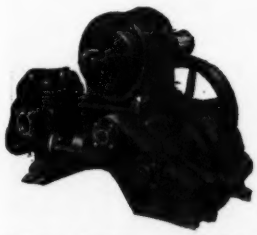

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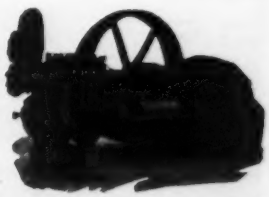

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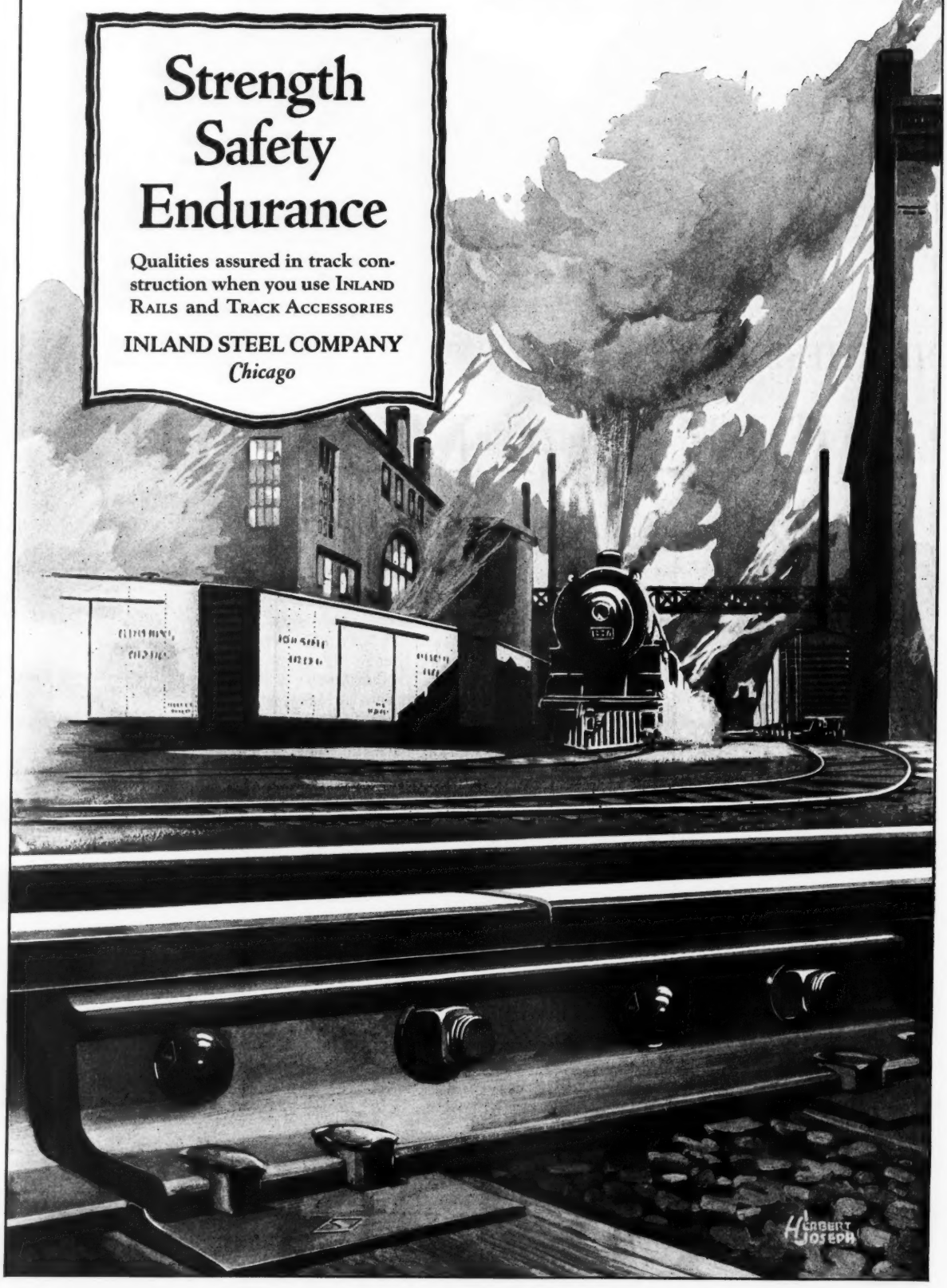

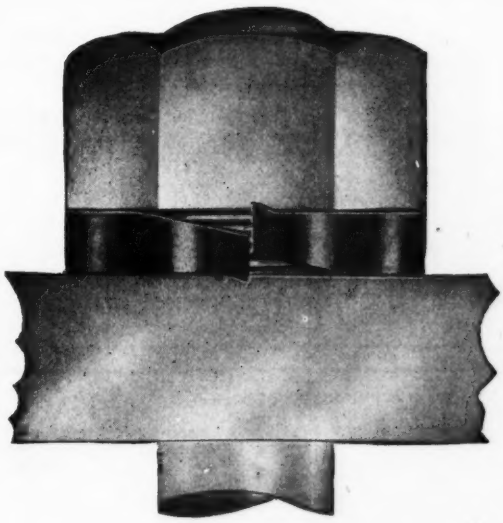

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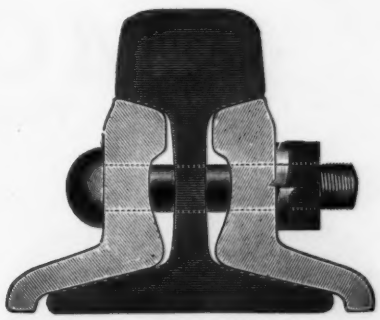

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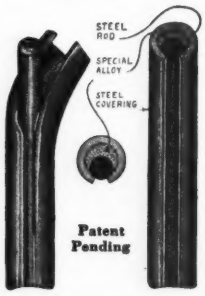

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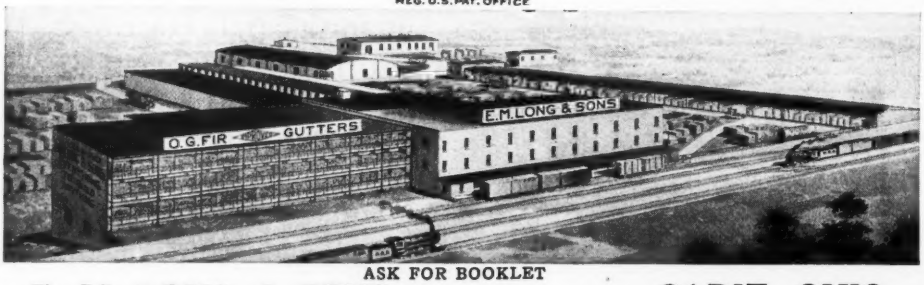

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HALF MILLION FEET
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Sizes
3 x 5
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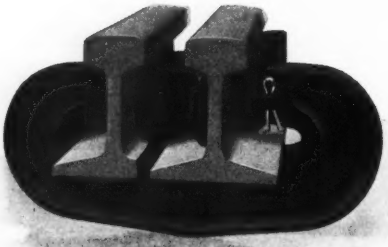
Lengths
10 to 40 Feet

LOOK BETTER
LAST LONGER
LESS EXPENSIVE

MORDEN

TRACK SPECIALTIES

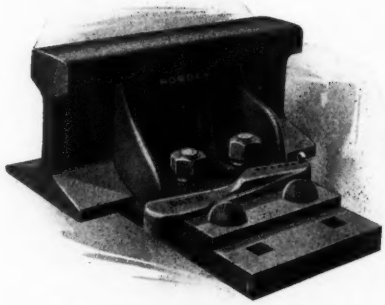


ADJUSTABLE GUARD RAIL CLAMP

A clamp for heavy service with universal drop forged yoke made of special heat treated steel.

This clamp is GUARANTEED. A clamp that is not dependable is expensive at any price.

Made for rails from 80 to 130 lbs. per yd.



ADJUSTABLE RAIL BRACE

A heavy malleable brace for general use on switches, slip switches and guard rails.

Should be in use on all interlocked switches to insure an easy and close adjustment for taking up wear between rail, brace and plate.

MORDEN FROG & CROSSING WKS.
CHICAGO

Manufacturers of

FROGS, CROSSINGS, SWITCHES SWITCH STANDS, GUARD RAIL CLAMPS

All Kinds of Standard and Special Track Work for Steam and Electric Railways

COMPROMISE JOINTS, RAIL BRACES, TIE BARS, DERAILS, SLIDE PLATES, ETC.

For Those Winter Jobs

THE creators of Headley No. 1, the original Cold Patching material, have provided in VIAFALT the basis of every advantage necessary to broaden the utility of a Cold Asphalt Cement.

In the building of grade crossings, depot platforms and similar points requiring smooth yet strong and durable operating surfaces, VIAFALT offers a low cost, long life and safe method that commends it to your favorable attention.

VIAFALT has all of the advantages of Headley No. 1 with the added features that it cannot be destroyed by freezing, and is successfully used when temperature is above freezing. It mixes readily and easily with all kinds of mineral aggregate.

Like Headley No. 1, VIAFALT imparts that extra measure of strength and bond required in durable construction.

Its use is proving an important building economy on many roads where the risk of performance is never entertained—the demand for accomplishment being absolute.

Ideal bonding material for Spring, Summer and Fall construction with these advantages—

Requires no heating.

No curing or drying—placed as mixed.

Coats either wet or dry aggregate.

Mixed by hand or machine, at point of installation or at central plant.

Always tough—will not push in summer nor crack in winter.

Headley Good Roads Company

Franklin Trust Building

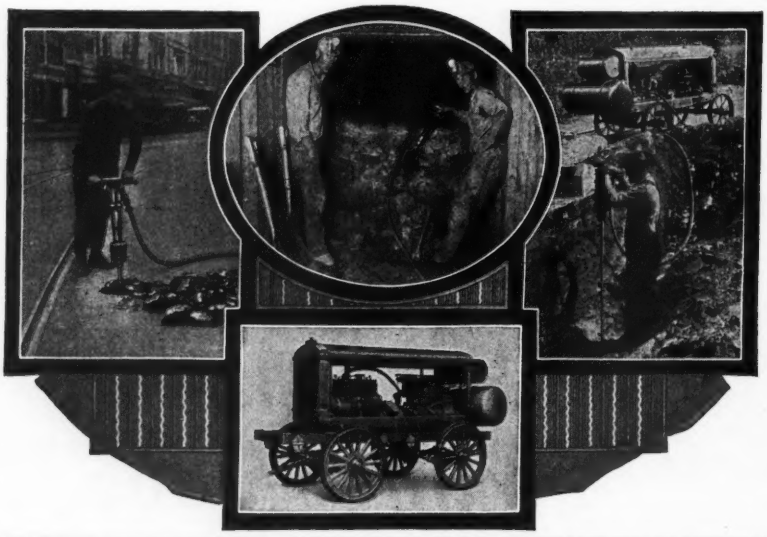
Philadelphia Pa.

VIAFALT

You Can do it quicker with Air

SPEED up your construction and repair jobs by putting compressed air on your payroll.

A Sullivan Portable Compressor will cut time and labor costs on dozens of odd jobs, such as rock removal, breaking concrete, sand blast cleaning, hoisting and hauling, painting, pumping water, calking mains, riveting or drilling steel work, etc.



Sullivan Portable Compressors are built in 3 types, for gasoline engine, electric motor, and tractor drive.

Gasoline types are direct connected to Buda, 4-cylinder, 4-cycle engines. Standard trucks have steel wheels, but trailer-type trucks with spring suspension and rubber tires may be had; also skid and Ford truck mountings.

Capacities, 100 cu. ft. and upward.

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Carlisle Pennsylvania

Established 1881

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HIGH GRADE MANGANESE STEEL CASTINGS
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STURDY AND RELIABLE

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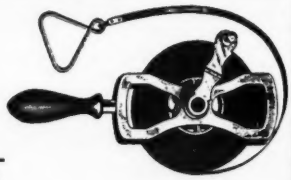
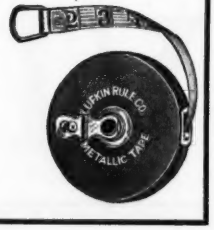


In Patterns Best for Every R. R. Requirement—Surveying—Engineering—Construction—M. of W. Steel Tapes with *Instantaneous* Readings and Nubian Finish. **Michigan Chain** (Chicago Style) **Tapes** with ½ gage mark and improved pattern reels.



Among our popular woven lines are the "Metallic," and the low priced tapes for all common uses, the Ass Skin, and the Universal No. 733R Linen Corded with First Three Feet Reinforced.

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BITUROC Crossing, Fortville, Ind.

Construct Them With

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TRADE - MARK

Natural Kentucky Rock Asphalt

BITUROC Crossing, Cincinnati, O.

Bituroc is a natural bituminous sandstone quarried and pulverized at our plant at Summit, Hardin County, Kentucky.

Bituroc is the most practical pavement for railroad crossings because it is delivered on the job ready to be laid COLD. Any section crew with the aid of rakes and a roller (large one not necessary) can lay it satisfactorily.

Bituroc is waterproof, noiseless, dustless and exceptionally non-skid.

Bituroc, due to its elasticity and resiliency, will withstand the vibration and impact of combined vehicular and rail traffic, where a more rigid type of pavement will crack and disintegrate under the strain.

Bituroc is also used extensively for station platforms, roadways, walks, etc.

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Incorporated

916 Schmidt Bldg. Cincinnati, Ohio

LAYNE WELL SYSTEM
FOR THE
DESERT LOCOMOTIVE

Even a camel, the famous desert locomotive, has to drink when he pulls into the City of Tunis, Africa, at the end of his long, sandy run.

In the picture below is the old aqueduct built by the Romans in the first century to bring water into the city. Old methods pass, and

Tunis has contracted with Layne Engineers to develop a modern guaranteed ground water supply for its 200,000 inhabitants.

The first well site was chosen by the Layne Engineers to be located close to the old Roman aqueduct where the dark spot appears on it in the picture.

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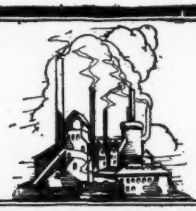

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DIXON'S
SILICA-GRAPHITE PAINT

for the economical protection of all metal and wood work.

Long service records of from five to ten years are obtainable with Dixon's Paint because of the unusual wear-resisting pigment—flake silica-graphite, and its vehicle—pure boiled linseed oil.

The pigment is inert, aids in preserving the original elasticity of the vehicle, increases the thickness of the paint film and has long life. The vehicle cannot be equalled by any other substance.

Write for new Booklet 187-B and long service records

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Jersey City, N. J. - Established 1827

Barber Brand Cold Repair Cement
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GRADE CROSSINGS AND STATION PLATFORMS

Low in cost—durable—absolutely waterproof—safer and far superior in every way to old style planks. Easily, quickly, and inexpensively laid. Used COLD—right from the barrel. No time or money wasted in heating. No cumbersome equipment needed.

Write at once for complete information regarding this remarkable product.

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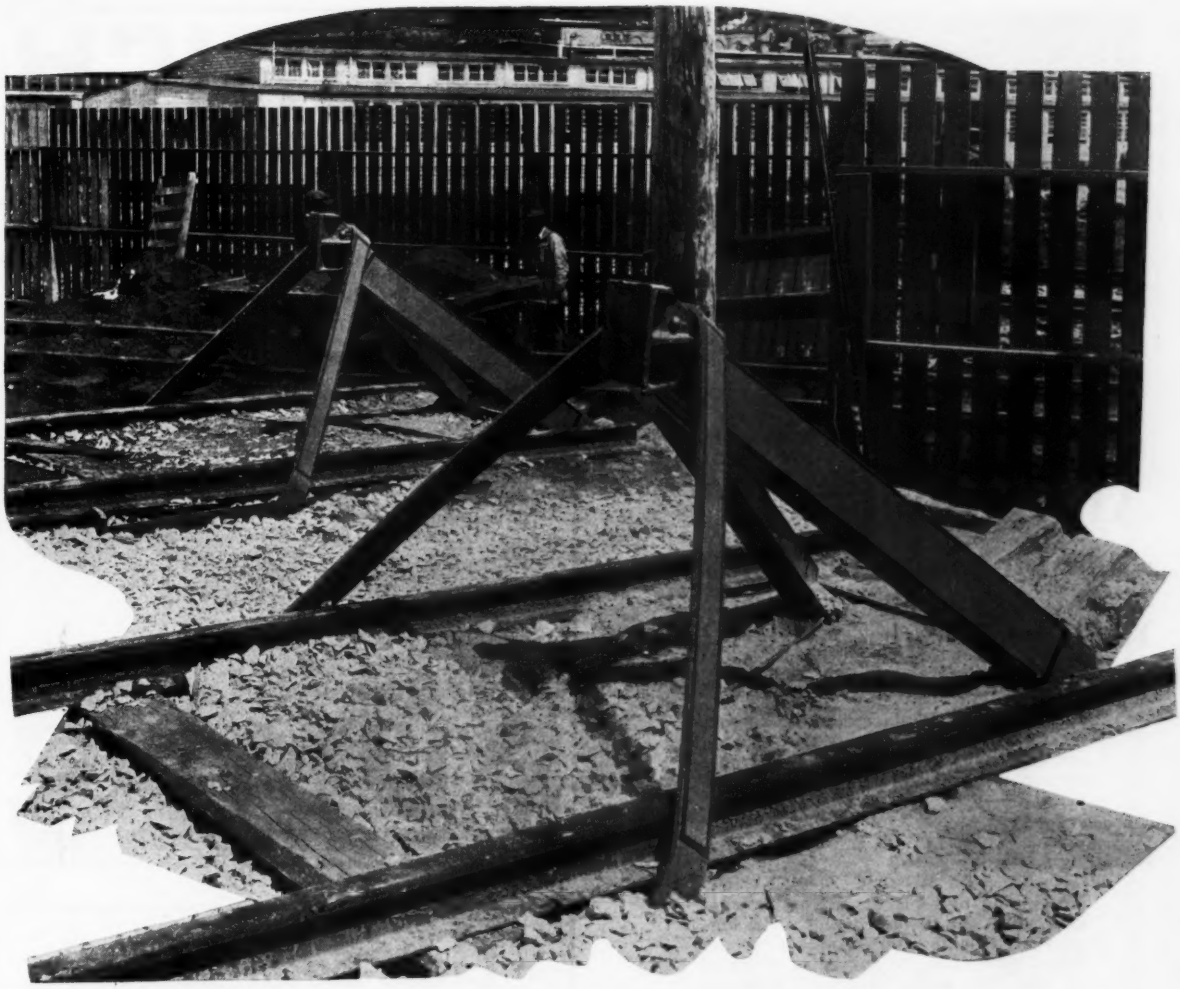

TO THE HUNDREDS OF RAILROAD MEN WHO WANT A BETTER BUMPING POST—WE OFFER THE LAWRENCE ALL STEEL POST

It anchors to the earth and takes the shock into the earth where it belongs.

Under a very severe blow it gives back dragging the earth with it thus protecting cars, contents of cars, and the post itself.

It reduces to a minimum your maintenance of posts and expense of repairing cars which are damaged by hitting rigid posts.

It increases your revenue car mileage.

It is easily and quickly installed, or reset when knocked back by a severe blow.

Immediate shipments can be made from stock.

Let us send you our circular.

LOUISVILLE FROG AND SWITCH COMPANY

Incorporated

LOUISVILLE KENTUCKY

All Wheels Off—
and the main line blocked

That's when you need the surety of Reading Replacers

Place Reading Replacers in the correct position with lugs engaging the rail base and rail head, and rerailment is a simple matter.

No tipping of replacers. No over-running rails. No flange-cutting. The lugs prevent tipping and establish proper flange-way. Can be spiked or clamped to rail by using Reading Replacer Clamps.

You may not need Replacers often, but when you do need them you want the best. Why not know Reading advantages. Write for illustrated folder, illustrating Reading Replacer design and showing how they operate. Seven sizes for all rail sections up to 136 pounds. Price on request.

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A PRODUCT OF THE American Chain Company, Inc. in business for your SAFETY

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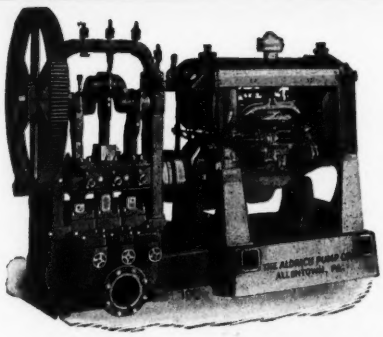
READING
Car and Engine
REPLACERS

ALDRICH



FOR ISOLATED POINTS
WHERE ELECTRIC CURRENT
IS NOT AVAILABLE

THE ALDRICH PUMP CO.
ALLENTOWN, PENNA.

VERTICAL GENERAL SERVICE TRIPLEX
HORIZONTAL HIGH PRESSURE QUINTUPLEX

PUMPS

Lime-Soda Water Softeners

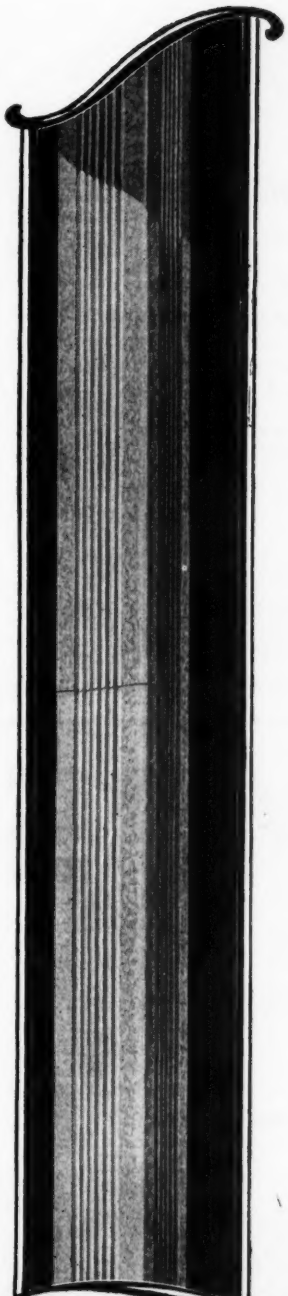
We make LIME-SODA WATER SOFTENERS of both the ground operated and top operated types to purify water for prevention of scale deposits and corrosion in locomotive boilers.

The saving that is being effected by purifying water is most ably portrayed in the recent report of the Water Service Committee at this year's Chicago Convention of the American Railway Engineers' Association. We recommend this report for your careful consideration.

Write for our literature which gives, in detail, the results of our twenty-three years' experience in furnishing WATER SOFTENER PLANTS to twenty-six American Railroads.

American Water Softener Company
Fairhill P. O. Philadelphia, Pa.
Specialists for twenty-three years in Railroad
Water Purification

HAND-DIPPED
CONDUCTOR PIPE



The exceptional durability and reasonable cost of Wheeling Hand-Dipped Conductor Pipe make it the most desirable pipe of its kind in *any* locality for any kind or style of building.

It possesses the rigid strength of the Copper-Steel that constitutes its base, and therefore does not crush or dent in handling. This insures a good workmanlike job and proper appearance on the building. And in addition to its strength of steel it affords the doubly efficient protection against rust through its rust-resistant base plus the heaviest known coating of pure zinc,—made possible by the hand dipping process.

The base of Wheeling Hand-Dipped Conductor Pipe is Ohio Metal (Copper-Bearing Steel) well known for its durability. In sheet form it is Terne Coated (Lead and Tin). After fabrication into perfect conductor pipe of all standard styles it is hand dipped in pure zinc. The seam becomes a soldered and zinc-sealed seam, making practically a one piece pipe. There is no other Conductor Pipe like it.

Wheeling also provides Hand-Dipped Elbows, made of the same material and by the same process, to be used with Wheeling Hand-Dipped Conductor Pipe, in addition to a full line of Hangers and Extra Heavy Coated Eavestrough.

One piece Corrugated Conductor Pipe Elbows and shoes

Hinged hooks plain or corrugated for brick or wood

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Galvanized Steel Wire Eavestrough Hangers

Eavestrough Hangers And Fittings

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General Offices — *Manufacturers of* High Grade Sheet Metals and Sheet Metal Building Materials — Wheeling, W. Va.

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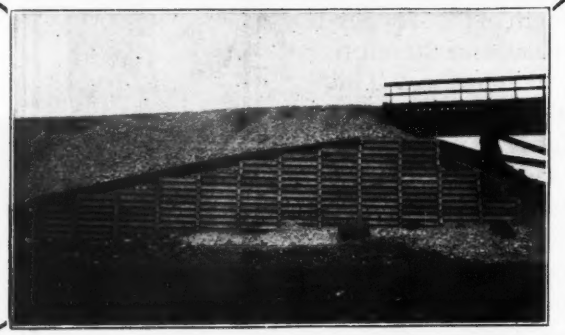
KONKRETE KRIBBING



THIS short section of Massey Concrete Crib Wall prevented the embankment from spilling over the highway thereby avoiding the expense of relocating the highway. This economical type of construction can be advantageously used for various purposes on every railroad. In addition to its common applications, it may also be used to retain fill at signal locations and motor car set outs, to stop sliding in wet cuts, to extend wing walls, to increase the height of old concrete or stone masonry walls, etc. This wide range of application is another reason why Massey Cribbing is being rapidly adopted. Have you our latest Catalog Supplement?

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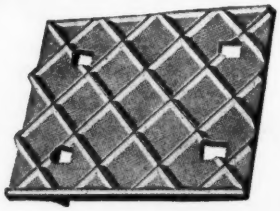
Other Products

Sellers Anchor Bottom



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Efficient
- Hold track to gauge
- Seat square to the rail
- Do not injure the tie
- Stop season checks in tie
- Bottom ribbing is a truss equal to one sixteenth inch additional solid section

Durable
- Rolled end over end
- Never break
- Made of Wrought Iron—corrosion retarded

Made in all sizes—with level or tapered rail seat, and with or without crown or cambre

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Bulletins on request

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CONCRETE SURFACER AND FINISHER

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The BERG surfaces and finishes concrete construction quickly, easily, efficiently and economically. No job too big. Used on buildings, bridges, walls, culverts, dams, foundations, monuments, etc.—interior as well as exterior work. Endorsed by leading contractors and engineers.

Portable, light, electrically driven. Can be operated on direct or alternating current. Supplied for either 110-125 or 220-250 voltage.

Send for details and list of prominent users.

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Department G
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One of the many great arches of the Ft. Snell Bridge at Mendota, Minn. Three BERGS are being used on this gigantic project.

The thinking man never disregards the practical value of reading such books as "Roadway and Track." This book covers in a sentence facts that theorizing would stretch to a page.

This condensation has permitted the author to do what few have done previously—make the least demand upon the readers' time in giving him the meat of modern maintenance practice. Your best bet is "Roadway and Track" if you want facts you can apply to your own work. You may keep this book for 5 days without cost. Order today.

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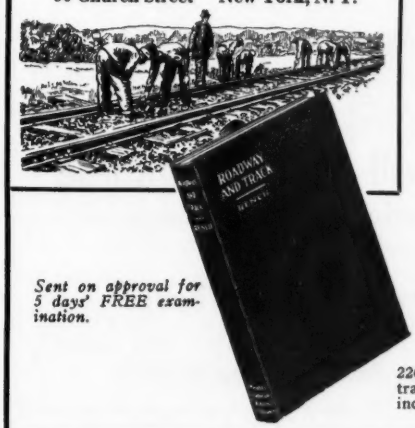
Your Best Bet



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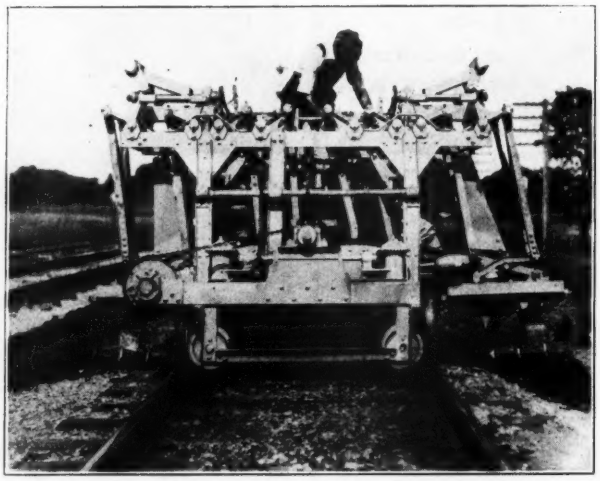
The Pease Peerless Continuous Electric Blue Printing Equipment (as illustrated) will cut your blue print costs 50%. It will pay you to investigate.

Just ask for Catalog M-23—it tells the whole story.

The C. F. Pease Company
854 N. Franklin St., Chicago

PEASE
BLUE PRINTING MACHINERY

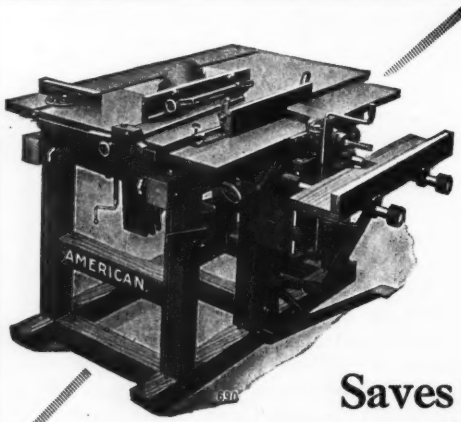
THE POWER SKELETONIZING MACHINE



Designed to clean out old ballast between ties preparatory to surfacing track or for digging out stone ballast. Equipped with transverse wheels for removing from track.

For further information write to

THE MAINTENANCE EQUIPMENT CO. Railway Exchange, Chicago



Saves its cost on the First Job

This American Portable Variety Woodworker lets you do any woodworking operation of either a routine or special nature right on the job. Figure the saving over hand or shop work! Hundreds are now in use.

This one machine may be used as a rip or cut-off saw, as a dado, gaining, grooving, rabbiting, tenoning or boring machine, as a jointer or planer, a matcher, molder or sander and as a hollow chisel mortiser.

Let us send you our Bulletin No. 80 describing our full line of Woodworking Machines for use on the job or in the shop.

American Saw Mill Machinery Co.
164 Main Street, Hackettstown, N. J.
"American" Saw Mills and Woodworkers

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Manufacturers of

Railroad Crossings, Frogs and Switches

Manganese Track Work a Specialty

Balkwill Cast Manganese Articulated Crossings

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(The Savers of Maintenance)

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8 to 30 YARDS

20 to 70 TONS

A. R. A. Standards

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30 YARD AUTOMATIC AIR DUMP CAR
STANDARD RAILWAY TYPE R
BUILT BY
MAGOR CAR CORPORATION
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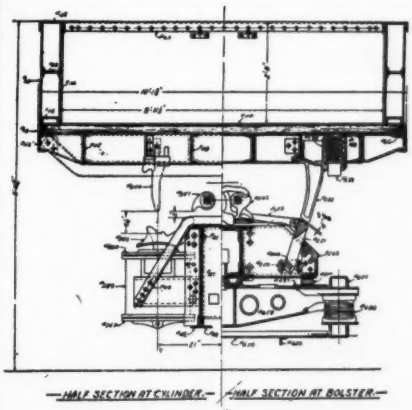
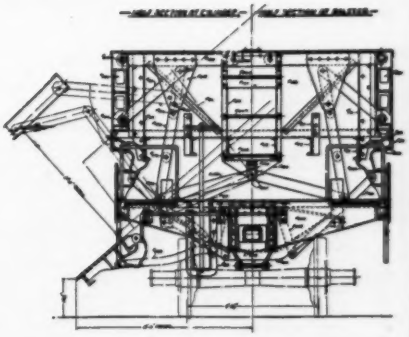
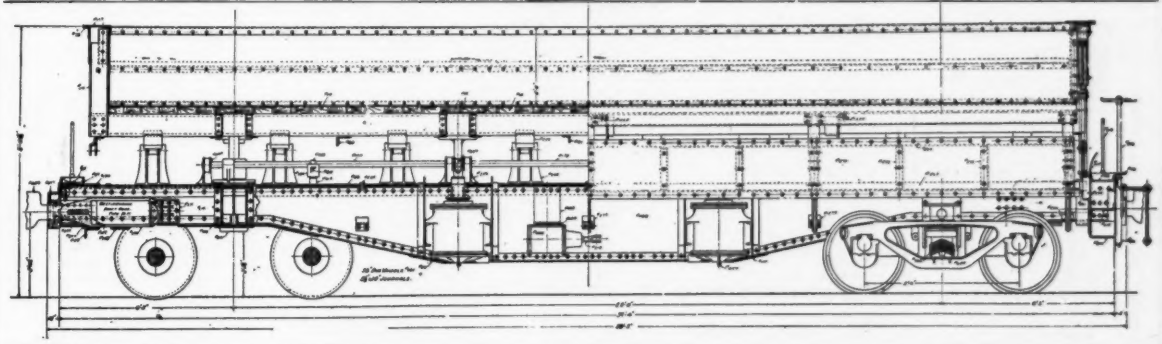
CODE WORD ZEODY

Cars equipped with Lift Doors, Aprons, Positive Dumping Locks, improved attachments.







Just specify "Hayes Bumping Post Type W". The one size in which it is made fits any rail from 56 lbs. to 130 lbs. per yard.

Nothing in the world will convince you more quickly of the value of this new bumping post than to put one in your own track where you have been having trouble with bumping posts; examine it critically and compare it frequently with other devices for stopping cars.

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Differential Steel Car Co.
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Western Wheeled Scraper Co.

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Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Mudge & Co.
Northwestern Motor Co.
Woolery Machine Co.

Cars, Motor.
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Rail Joint Co.

Joints, Rail.
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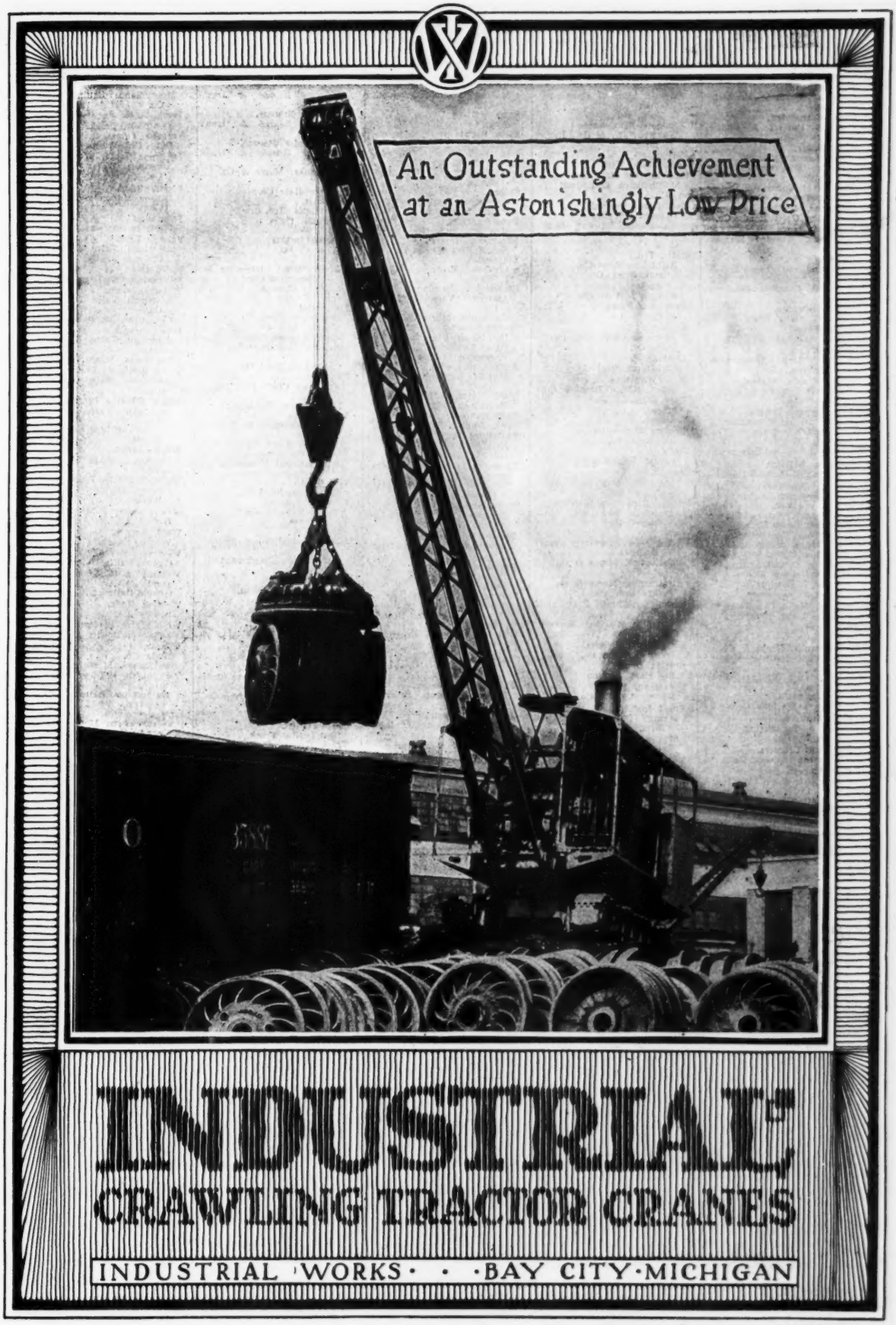
Pipe Carriers.
Massey Concrete Products Corp.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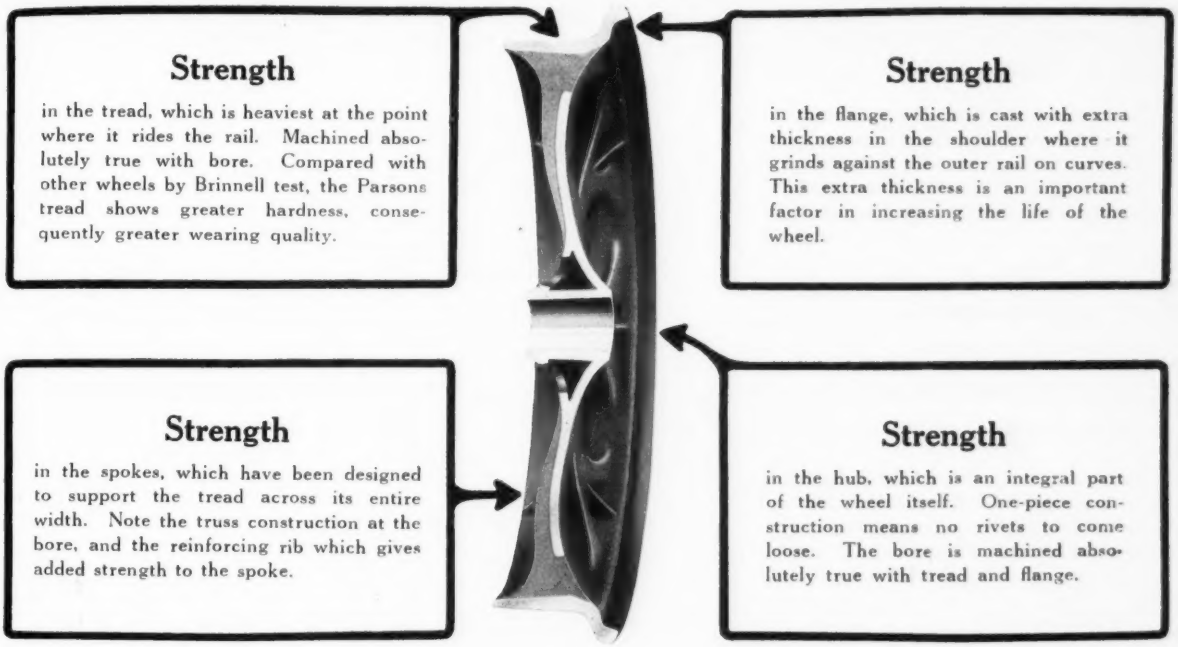
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in the tread, which is heaviest at the point where it rides the rail. Machined absolutely true with bore. Compared with other wheels by Brinnell test, the Parsons tread shows greater hardness, consequently greater wearing quality.
Strength
in the flange, which is cast with extra thickness in the shoulder where it grinds against the outer rail on curves. This extra thickness is an important factor in increasing the life of the wheel.
Strength
in the spokes, which have been designed to support the tread across its entire width. Note the truss construction at the bore, and the reinforcing rib which gives added strength to the spoke.
Strength
in the hub, which is an integral part of the wheel itself. One-piece construction means no rivets to come loose. The bore is machined absolutely true with tread and flange.

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Strength means Safety. Safety because of the extra thickness of the flange that triples the life of the wheel. Safety because of one-piece construction that eliminates the dangerous rivet.

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ONE-PIECE CAST-STEEL *for* **RAILWAY MOTOR CARS**

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